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THE DEVELOPMENT OF DECENTRALIZED SYSTEMS OF BUILDING MATERIALS PRODUCTION IN AFRICAN COUNTRIES

SUMMARY

on the development of decentralized systems of building materials production in African countries

The objective of the study "The Development of Decentralized Systems of Building Materials Production" is to highlight some aspects of building materials industry in order to assist the governments of African countries in planning and implementation of building materials development programmes.

The products of building materials industry cover a wide range and find a variety of uses in new building and engineering constructions as well as in the maintenance and renewal of existing constructions, so the goal in the creation of a viable local building materials industry derives from the awareness to achieve an increasing measure of self-reliance in all facets of national economic-life through the optimum utilization of the existing local resources.

A brief overview on conceptual framework and importance of the building materials industry to national socio-economic development is given in the Chapter I of the study.

Chapter II is dealing mainly with the needs for Decentralized systems of building materials production in the light of needs for local production as well as stimulus for diversification in range of available building materials. The term "Decentralization" used in this study has a limited meaning and refers to the process of establishing plants of varying sizes and employing of mix of large-scale, medium-scale and small-scale technologies based on the raw materials available in different locations within the African countries.

The study underlines, that properly planned Decentralized systems of building materials production could make an important contribution towards improving the supply situation of some essential building materials, particularly towards the low cost construction. In connection with it an attention should be given to the development of an informal sector of the building materials industry. In many African countries, most of dwellings for urban and rural population are constructed using such building materials as sun-dried mud blocks, cement blocks, wooden doors and windows as well as clay tiles for roofing. For a majority of these materials, the production is usually organized in small-scale plants which can be termed "informal sector of the building materials industry" when related to conventional systems of production.

Small-scale building materials production in the context of the informal sector of building economy is an activity which has been established on an extensive scale in most African countries.

This sector can operate with little or no dependence on support from national governments. Even though the sector could probably maintain its current role without any external support, it seems reasonable to suppose that constraints which limit the maximization of development contributions from the sector could be reduced by providing some forms of assistance.

PREFACE

The building materials industry in several African countries has failed to meet the requirements of the construction industry for building materials in the desired quantities and at affordable prices. The result has been a slowing down of the pace of implementation of projects and the augmentation of construction costs. African governments are conscious of the need to achieve an increasing measure of self-sufficiency in the supply of building materials and have accordingly included the building materials industry among the core industries for the Industrial Development Decade for Africa programme.

The basic problem of the building materials industry stems primarily from the failure of the few large-scale plants, set up in centralized locations to produce a limited range of materials, to achieve the expected output levels. The need to review past strategies and adopt new approaches to the development of building materials production became apparent.

This document has been prepared by the Economic Commission for Africa to assist African Governments in the planning and implementation of building materials development programmes based on the concept of decentralization and diversification of production.

The document consists of an introduction and six chapters. The introduction discusses the development of the building materials industry and the concept of decentralization. Chapter I gives a brief overview of the industry covering the conceptual framework of the industry, its importance to national socio-economic development, its linkages with other industries and sectors, and the prospects for its development in African countries. In Chapter II the need for decentralized systems of building materials production is analysed. Chapter III deals with the problems associated with decentralized systems of materials production and how they could be overcome. Chapter IV is devoted to a discussion of the various elements concerning the planning of decentralized production systems, including basic data for planning production systems, the choice of materials to be produced, the choice of production technology, the assessment of infrastructural facilities, manpower needs, the preparation of the building materials development plan and the machinery for the coordinated planning and development of the industry. The implementation of programmes and projects for the establishment of building materials production units is the subject of discussion in Chapter V. Chapter VI gives a summary of some of the main policy measures that should be considered for implementation by African governments with regard to the planned and coordinated development of the building materials industry.

This informal sector of production, as with several other informal-sectors economic activities, has emerged partly as a continuation of age-long traditional activities but also as a modern system of production to provide such elements as sun-dried mud blocks, cement blocks, stone blocks, wooden doors and windows which the conventional systems of production have not been capable of providing to the satisfaction of the entire construction market.

Since the sector has a potential for generating skills and high levels of employment as well as ability to stimulate growth of production in other sectors, governments could consider their support for the informal sector as a significant strategy in the context of an overall economic development plan.

Because of implementation of Decentralized systems involves a number of related problems the study considers the factors as absence of basic infrastructure and complementary industries, which could act as severe hindrances to the implementation of the decentralized production systems as well as the problems relating to availability of suitable technologies and energy (Chapter III).

As is pointed in the Chapter IV of the study, to implement the Decentralized systems of building materials production it should be properly planned, so to the purpose, basic data for planning should be available and investigated. On the issue, priority should be given to studying natural resources, production and consumption of building materials and its perspectives. It is necessary to select the building materials for local production and to make a choice of production technology as well as to assess infrastructural facilities and manpower needs.

Because of a decentralized system of building materials production is a part of state building materials industry, it should be include in the building materials development plan, implementation of which is under control and coordination of the state machinery.

Practical recommendations on implementation of programmes and projects for the establishment of building materials production units are given in the Chapter V and VI of the study.

They are covering the following elements:

- Basic requirements
- Institutional support
- Small-scale industries development organizations
- Incentives for building materials production
- Financing of building materials projects
- Mobilization of funds from local sources
- Research and development activities
- Information, training and extension services
- Local fabrication of machines, equipment and tools
- General policy measures

INTRODUCTION

The development of the building materials industry and the concept of decentralization of production

1. The development of a local building materials 1/ industry has assumed increasing importance in all African countries because of a growing concern among Governments of severe constraints to the implementation of construction programmes arising, among other factors, from the periodic and sometimes chronic shortages of essential building materials which have also become very expensive with time. Hitherto there has been heavy dependence on imported items of building materials, however dwindling foreign exchange reserves and competing demands by other sectors of the national economy for these limited resources, have made it increasingly difficult for Governments to maintain imports of building materials at levels commensurate with the requirements of the construction sector.

2. The interest in the creation of a viable local building materials industry also derives from the awareness to achieve an increasing measure of self-reliance in all facets of national economic life through the optimum utilization of resources available locally. In the context of the building materials industry this means the exploitation of potentially - useable raw material deposits of various sizes that are found in different locations across the national geographical space to produce building materials required by both the formal and informal construction sector.

3. In their programmes to develop the local building materials industry several African countries initially adopted a strategy which favoured the installation of large-scale, capital-intensive plants sited in a few locations and producing a limited range of materials which met the specifications of building codes and regulations based essentially on foreign design concepts and building technology. The failure of such plants to make an appreciable impact on the supply of building materials and its causes are well known - wrong choice of technology, lack of qualified technical, supervisory and managerial personnel, maintenance and repair problems caused sometimes by lack of foreign exchange to import needed spare parts, low utilization of installed plant capacities, distribution problems arising from long-distance haulage over poorly developed transport networks, etc.

4. In the light of the problems that have been experienced with regard to efforts aimed at increasing the production locally of essential building materials it becomes necessary to review past strategies and formulate new approaches for adoption.

Decentralization of building materials production

5. The term decentralization used in this document has a limited meaning and refers to the process of establishing plants of varying sizes and employing a mix of large-scale, medium-scale and small-scale technologies based on the raw materials available in different locations within the country with the following objectives in view:

(a) contributing generally to improving the supply of building materials to the construction market at different demand points and minimizing the rate of price escalations;

1/ In the context of this discussion the term "local building materials' refers to all materials produced locally from essentially locally available resources, although there may be some imported inputs.

(b) diversifying the range of materials available for construction through rational exploitation of all potentially useable raw material deposits;

(c) making use of raw material deposits of different sizes to meet the demands of different market sizes and climatic conditions;

(d) reducing the problems associated with long-distance transportation of a limited range of building materials produced in a few centralized locations.

6. Another aspect of decentralization that has relevance to this discussion concerns the splitting of the production process among different locations. For example, in the production of portland cement, it might be found, economically, advantageous under certain conditions to set up a clinker plant at one location and then grinding centres at other locations where the clinker will be interfuse with gypsum and other additional elements to produce cement.

7. Decentralization of the system of building materials production as explained above entails some implications with regard to programme planning and implementation, if successful results are to be achieved. These include the following:

(a) Provision of basic infrastructure and services - roads, water supply, electricity (energy), etc. to facilitate establishment of production units;

(b) Knowledge of the raw material situation and production possibilities in different regions and districts within the country;

(c) Availability of a bank of technologies to support different scales of production in various localities;

(d) Existence of research and development infrastructure to assist in the development and adaptation of production technologies to suit local conditions and to assist in the transfer of such technologies to prospective entrepreneurs and other users;

(e) Development of indigenous capacities for the design and fabrication of machines, equipment and spare parts to meet the requirements of production units;

(f) Existence of technical, financial and promotional organizations to assist investors in the public and private sectors, and in the large, medium and small scale sectors;

(g) Development of a cadre of technical, supervisory and managerial personnel, including entrepreneurs, to ensure the successful establishment and operation of materials production units;

(h) Creation of suitable institutional mechanisms to provide the framework for co-ordination of efforts of all concerned organizations and undertake preparation of plans and programmes and monitor their implementation.

8. It is clear from the foregoing that the successful promotion of a decentralized approach in the production of building materials requires a deliberate planning and promotional effort by governments to create those conditions that would favour the

establishment of production units not only in urban settlements, but also in small town and rural locations where market and other locational considerations would normally rule out such investments.

CHAPTER I

THE BUILDING MATERIALS INDUSTRY - A BRIEF OVERVIEW

Conceptual framework of the building materials industry

9. The building materials industry, whose output - building materials and components - constitute an indispensable input for the implementation of construction projects, is difficult to define precisely, and no generally accepted definition exists. The difficulty in formulating a precise definition for the industry stems mainly from three factors: the existence of an overlap between the building materials industry and other industries, particularly the construction industry; difficulties relating to the classification of plants producing materials such as iron and steel, plastics, ceramics, wood and wood-based products, which are used in industries other than construction, and; problems associated with the recognition of the production of some materials as a manufacturing activity.

10. The products of the building materials industry cover a wide range, and find a variety of uses in new building and civil engineering constructions, as well as in the maintenance and renewal of existing constructions. They include cement and cement-based products, iron and steel products, other metal products, wood and wood-based products, bricks and other burnt clay products, glass, paints, sanitary ware and roofing materials. At the other end of the spectrum of materials are fittings, such as hinges, padlocks, nails, screws and bolts. It is important to give proper recognition to the full range of materials required by the construction industry and plan for them accordingly since critical shortages of even low value materials like hinges and nails can lead to considerable delays in the completion of certain construction projects.

11. The building materials industry is characterized by flexibility in choice of production technology for a number of materials. The industry therefore comprises both highly capital intensive plants and low capital, labour-intensive plants. Possibilities exist in between these two extremes for technologies with varying capital-labour ratios. Large scale plants exist together with small-scale artisanal plants, each category producing materials to satisfy the requirements of specific user groups. Thus, high technology, large scale plants producing high quality bricks are found alongside artisanal plants producing bricks of a much lower quality. Plants for materials like glass, iron and steel, and cement however, tend to use high technology with high output levels.

12. The main participants or actors involved in the building materials industry are the manufacturers, both in the formal and informal sectors, the distributors/retailers, and the consumers, both private and public. The activities of informal sector manufacturers are usually not sufficiently reflected in statistics on the output of the building materials industry probably because they are not officially registered, and thus not recognized as manufacturers. In some countries however, the informal sector produces significant quantities of materials like burnt bricks, lime and concrete blocks.

13. Even though their functions may only be partly concerned with the building materials industry, bodies such as financial institutions, building research and standards organizations, and industrial promotion organizations constitute important links in the process of achieving the output of the industry. Their roles and

contributions should therefore be reflected in discussions and programmes aimed at resolving the inherent problems of the building materials industry.

Importance of the building materials industry to national socio-economic development

14. The importance of the building materials industry to the national economy can be assessed primarily by its contribution to construction output. Building materials and components account for about 60 per cent of the total value of construction output, the remainder being accounted for by labour, plant, equipment and overhead. The construction industry itself contributes about 40 to 50 per cent of capital formation and 4 to 11 per cent of gross domestic product in African countries.

15. Over 3 billion dollars are spent annually by African Governments to import building materials and components from overseas markets. This is about half the amount spent on food imports annually. It goes without saying that concerted local production geared towards import substitution would greatly help to release some foreign exchange which would otherwise have been committed to building materials imports, for meeting other national import needs.

16. Inadequate supply of essential building materials does not only result in a long list of uncompleted projects which lock up much-needed capital; it also leads to cost escalation in construction which is detrimental to the quest for economic use of scarce financial resources. The availability of abundant supplies of building materials at affordable prices is a prerequisite for the successful implementation of housing programmes geared to the satisfaction of one of the basic needs of the population, namely, shelter.

17. Apart from its significant contribution to the creation of social overhead capital - buildings, civil engineering works, etc. - required for production activities in other economic sectors, the building materials industry also contributes to employment generation and income redistribution. Statistics on its contribution to employment creation are however lacking since the industry is very often treated under the construction industry in national accounting.

18. Building materials production at all levels, promotes the development of skilled manpower which is not only an asset for the further development of the industry itself, but could easily be employed in other sectors of the economy.

Relationship to construction industry and other inter-sectoral linkages

19. The construction industry is the primary consumer of the output of the building materials industry; the linkage between the two is so strong that it is impossible to consider one without giving attention to its impact on the other. Thus, any upward or downward movement in the volume of construction activity exacts a proportionate effect on the building materials industry. Unstable construction demand schedules therefore, pose a serious constraint to the orderly and planned development of the building materials industry. In a similar way shortages of building materials and components adversely affect the pace of construction projects, causing delays which eventually lead to high construction costs. An important deduction from this analysis is that building materials should be produced to meet anticipated construction demand, and that in planning construction programmes adequate attention should be given to the ability of the building materials industry to supply the required inputs.

20. Through its contribution to construction output, for example, irrigation schemes, dams, roads, buildings, etc., the building materials industry reveals its relationship with other sectors like agriculture, energy, transportation and manufacturing. This relationship with other sectors like agriculture, energy, transportation and manufacturing. This relationship extends to virtually every sector of national economic activity. Building materials production units generate backward linkages through the consumption of inputs from other sectors, as for example, in the manufacture of plant, equipment, tools and spare parts. One has to admit that in the majority of African countries this kind of manufacturing activity has not developed to an appreciable degree. This factor seriously hampers the development of local technological capabilities and the maintenance of imported technologies in a situation of foreign exchange shortage for the importation of spare parts.

Present situation and prospects for development

21. The building materials industry is important to national socio-economic development, particularly through its contribution to the creation of social overhead capital. The industry is however plagued with several problems. In many African countries there is shortage of much-needed building materials and what is available is expensive. This situation has been caused mainly by the lack of foreign exchange for importation of building materials, and by the poor performance of production plants that have been set up.

22. The building materials industry in several African countries is generally characterized by: a low growth rate; lack of decentralization and diversification of production; use of inappropriate production technology; low utilization of installed plant capacities; low level of technical and managerial skills; inadequate standardization and quality control; inadequate research, technology and information infrastructure; and inadequate policy, planning and promotional support.

23. The planned development of the industry in order to enhance its capability to meet national requirements of building materials and components at reasonable prices and in the required quantities has not received high priority in many national development plans. There is still need for the generation of workable policies geared towards the coordination of the development of the building materials industry with the anticipated demand for construction.

24. Available information shows that African countries have great potential in terms of raw material availability, to increase local production of various building materials like cement, lime and lime-pozzolana, burnt clay products, wood and wood based products, sanitary ware, etc., This would not only increase the supply of building materials, but also help to reduce the dependence on foreign sources of supply. Even though the raw materials and other factor inputs are not evenly distributed among the different countries in the region, possibilities do exist, within the framework of the principle of collective self-reliance, for groups of countries to undertake joint actions for the production and distribution of specific building materials.

25. The modality for increasing the supply of building materials could be viewed in the light of three component parts each of which should be accorded priority attention.

(a) Achievement of better utilization of already installed production capacities based on an in-depth evaluation of the problems of the plants and

implementation of the necessary remedial measures;

(b) Planning and establishment of new plants based on an assessment of future building materials needs and an evaluation of local raw materials that could be most advantageously used in the light of the availability of other factor inputs;

(c) Development of "new" building materials based on available raw material resources and successful Research and Development work carried out within the countries, other African countries or elsewhere. The use of agricultural and industrial waste materials as well as other potential resources hitherto neglected should be encouraged.

26. In order to fully realize the potential offered by available resources for increasing the supply of building materials through local production efforts, some basic conditions need to be fulfilled. They include the following:

(a) Renewed political commitment - this should lead to the formulation, by governments, of clearly-defined policies and long-term programmes for the building materials industry, coupled with adequate financial allocation to ensure achievement of targets of planned programmes;

(b) Development of effective research and information infrastructure - to provide suitable technologies, assist in standardization and quality control, formulation of locally-relevant building codes and regulations and propagation of information to various user-groups;

(c) Emphasis on manpower development and training - to provide managerial and technical skills to cope with the requirements of technologies adopted,

(d) Development of tools and spare parts industry - to fabricate simple tools and machines for the building materials industry and also spare parts for the repair of building materials plant and equipment.

CHAPTER II

THE NEED FOR DECENTRALIZED SYSTEMS OF BUILDING MATERIALS PRODUCTION

The need for local production of building materials

27. The necessity to emphasize the local production of building materials in African countries stems primarily from the origin and nature of supply of the bulk of materials used especially in the modern construction sector. The procurement of materials from overseas sources, stimulated during the colonial era and reinforced by acquired official and public prejudices, foreign educational curricula and design concepts, has contributed to the poor state of the building materials supply situation in many countries in recent times. Dwindling foreign exchange reserves have necessitated the reduction, sometimes drastic, in the financial allocations for the import of finished materials and components, as well as raw materials and spare parts for plants set up as import substitution industries. The resulting shortages, chronic in some countries, and the consequent high cost constitute a serious constraint to the smooth implementation of both public and private construction programmes.

28. Arguments could be made in favour of continued importation of some building materials in countries where foreign exchange constraints do not exist, on the grounds that locally produced equivalents would be more expensive. This might be sustainable only in the short-term. Imported inflation resulting from high production, energy and transportation costs in the countries of origin could eventually lead to uncontrollable price escalations. The current situation in a number of countries has been caused precisely by this phenomenon.

29. The justification for the local production of building materials should therefore be viewed in the context of national economic and social considerations. The urge to achieve a measure of self-sufficiency in the supply of building materials based on maximum utilization of locally available resources, the creation of employment opportunities, the conservation of foreign exchange to be used for other pressing national needs and the enhancement of the development of the local industrial sector, are all important factors that need to be kept in view.

30. It would become necessary sometimes to set up plants for which a portion of the raw material inputs would have to be imported. In such cases, the need for maximising the use of scarce resources should underlie considerations of technology choice at the planning stage. Technologies which entail the use of less of the scarce capital- and foreign exchange resources would be preferable.

31. The continued importation of certain items of building material may be necessary mainly because their production locally may not be feasible. In such cases, investigations could be made to explore the possibility of introducing substitute materials produced locally as a long-term objective.

32. In summary, the guiding principle with regard to decisions on the production of building materials should always be the maximization of the use of available national resources and the progressive local control of the factors that regulate the supply of building materials to the construction industry.

Nature and deficiencies of existing production systems

33. The majority of plants set up in many African countries during the past 25 years to produce some items of essential building materials share some or most of the following characteristics:

(a) application of highly capital intensive (sometimes sophisticated) technologies,

(b) use of a high component of imported raw materials,

(c) concentration in a few locations, specially in the vicinity of capital cities and other large towns,

(d) initially established through turn-key contracts for which technical and management expertise was provided by foreign exprrts during the initial years of operation,

(e) maintenance and repair problems arising from the need to import spare parts for which foreign exchange may be lacking when needed,

(f) low utilization of installed plant capacity due to factors including lack of raw materials, plant repair problems (sometimes inability to replace obsolete machinery and equipment), lack of qualified technical and managerial personnel, unstable demand schedules.

34. Following the introduction of building materials like portland cement for which plants were set up locally or funds were available for their importation, there has been a tendency to neglect artisanal methods of production which had hitherto produced the bulk of materials like burnt bricks and lime used predominantly in the informal building sector in both urban and rural areas. Thus, traditions established over long periods of time have been lost. Artisanal production methods are still practised in some countries, for example in Malawi, Ethiopia, Rwanda, Burundi and Zaire.

35. The deficiencies associated with existing patterns of production have been evident from the persistent shortages and high cost of building materials in several countries. Geographical availability of materials has also been problematic because of constraints associated with moving them from centralized plants to all locations within countries where transport networks are poorly developed. High transport costs lead to a doubling of building materials prices in some localities.

36. It is also evident that investments in production units that have been operating at low capacities, often below the break-even point, have been uneconomic from the view point of utilization of scarce financial resources. Experiences to-date call for a critical review of past strategies and criteria for investments in building materials plants. The new strategies and criteria should aim at contributing to eliminating the deficiencies that characterize existing production systems.

Decentralization as a stimulus for diversification in range of available building materials

37. It has already been observed that a major defect of building materials production systems at the national level in the past has been the concentration of plants in a few locations, sometimes producing only a limited range of materials. While it is

true that this pattern was dictated by optimal locational choices based on availability of raw materials infrastructure and services for production and accessibility to profitable markets, it tended to ignore production possibilities in small localized market zones.

38. Two aspects of decentralization of production deserve mention. Firstly, situations may arise in the production of a specific material where it may be necessary to break up the production process among plants in different locations. For example, in the production of portland cement, economic considerations may require that clinker is produced near the source of raw material, and hauled to clinker grinding centres in different locations, near the major consumption centres.

39. The second aspect of decentralized production concerns the deliberate promotion of production units based on the concept of utilization of available raw material reserves, irrespective of size, through the application of appropriate production technologies, to serve markets which may be of a local, regional or national character. This approach permits a thorough examination of all possibilities for building materials production in the country and offers a practical basis for increasing the supply of materials through an optimum use of local resources. To this end the increased production of materials like lime, lime-pozzolana, burnt bricks, clay roofing tiles, sawn timber, etc. which are easily amenable to the use of medium- and small-scale technologies could be enhanced.

40. This system of production is advantageous because it helps to improve the situation regarding the supply of some building materials in the area of influence of the production units. It also helps to reduce the incidence of long distance haulage of materials which is not only costly, but sometimes is constrained by inadequate transport networks.

Decentralization as a stimulus for the development of local technology, skills and entrepreneurship

41. The concept of decentralization of production is intrinsically linked to the adoption of different levels of technology to suit the conditions in different localities within the country. Thus a technology mix of large- medium- and small-scale technologies would be required depending on the scale of production envisaged.

42. There is currently a gap in production technology in African countries, particularly with regard to those suitable for small-scale enterprises. The viability of decentralized system of production would therefore be contingent upon the development of a bank of appropriate technologies. This development could have favourable consequences for the national economy as a whole as illustrated below.

(a) It should give an impetus to research and development institutions, as well as industrial promotion organizations, to strengthen their activities geared to the development of appropriate production technologies, thereby raising their level of expertise and increasing the technological wealth of the country;

(b) The machines, tools and equipment required for locally developed production technologies or those adapted from foreign technologies, would create a demand that would be conducive to the development or strengthening of indigenous capacities for their fabrication;

(c) Linked to (a) and (b) is the development of skills in the production of items of building materials, as well as in their utilization in construction;

(d) The availability of a technological base that provides a range of options would help in stimulating the interest of entrepreneurs specially in the small-scale sector. The successful integration of such entrepreneurs in the production sector would augur well for the developeent of local entrepreneurship in the building materials sector. The experience gained by entrepreneurs in this sector could easily be applied in other productive sectors of the economy.

43. Decentralization of the productoon of building materials should thus be viewed as an instrument for enhancing the general economic, social and technological development of the country.

The role of small-scale building materials units in decentralized production systems

44. The promotion of small-scale manufacturing industries has assumed increasing importance in recent times as an industrial development strategy, especially in rural areas. Not that these industries did not make any significant contributions to the achievement of national develo,ment objectives in the past. However, in many countries of the third world, small-scale building materials industries and others operated predominantly by the informal sector, had been neglected and thus faced serious problems, including lack of development infrastructure that would afford assistance and facilities with regard to finance, technological innovation, rationalization of production units, technical and managerial training, quality control and standardization. The resulting inefficient operations and poor quality products detracted from the expansion of the role of small-scale units in the production of the materials required by the construction sector, both formal and informal. Unfortunately, most of these problems still prrsist in many African countries.

45. The nature of construction demand and the distribution of natural resources, combined with the inherent advantages of small-scale building materials units create a situation where such units could play a vital role in meeting the demand for building materials. These factors are elaborated briefly below.

(a) The demand for construction is dispersed over the national geographical space;

(b) Climatic factors sometimes favour the use of certain building materials rather than others. For example, burnt-bricks, because of their superior insulating properties are more suitable than concrete blocks for wall construction in hot dry climatic zones;

(c) Small-scale production units are able to utilize dispersed and small raw material deposits to serve local markets; this is specially vital in the context of rural areas where local demands are usually small;

(d) In meeting the local demand for some building materials, small-scale plants help to minimize the impact of the problems of long-distance haulage of building materials on local construction activities;

(e) Flexibility in the scale of production can be achieved in small plants, because of low fixed costs, adjustments in production levels could be made in consonance with demand fluctuations without disastrous consequences on future operations as is the case with large-scale and capital-intensive units;

(d) Because of low capital investments, small-scale plants should normally be easier to finance and are therefore more likely to be in the reach of local entrepreneurs and co-operatives;

(g) Small-scale plants tend to be labour-intensive and therefore offer prospects for high employment generation;

(h) Small-scale plants also generally have low energy requirements, depend little on imported inputs, and thus make fewer demands on scarce foreign exchange.

46. The contribution of small-scale plants to the supply of building materials is not clearly known and therefore not fully appreciated in many African countries because their activities are not usually reflected in the official production statistics. This could have contributed to the low priority for the development of such plants in government industrial promotion programmes in the past, and hence their poor present state. It should be observed however, that some countries have set up industrial development and promotion organizations to cater to the specific needs of small-scale industries. For example, the Kenya Industrial Estates Limited (Kenya) and the small Industries Development Organization (Tanzania) were set up respectively in 1967 and 1973, both with mandates to asist in the establishment and running of small-scale industries in the respective countries.

47. National strategies and programmes for the development of small-scale industries should be formulated and implemented in countries where this has not already been done, so as to exploit the potential contribution of small-scale building materials production units to the minimization of building materials supply problems. The characteristic problems of small-scale manufacturing ventures should be recognized so that adequate remedial measures can be instituted. Some of these measures are discussed further in Chapter V. They include the setting up of industrial development and promotion organizations with emphasis on building materials (and other) industries to provide assistance with respect to the mobilization of financial resources, training for production and managerial skills, planning and rationalization of production units, provision of access to information sources. Standardization and quality control of the products of small production units and the recognition of such products in national building legislations also deserve urgent attention.

CHAPTER III

PROBLEMS OF DECENTRALIZED SYSTEMS OF BUILDING MATERIALS PRODUCTION

48. While decentralized systems of building materials production, properly planned and executed, could make an important contribution towards improving the supply situation of some essential building materials, it has to be recognized that there are factors which could act as severe hindrances to the implementation of such production systems.

49. Some of the problems associated with these factors could be overcome through government policy measures and the introduction of suitable technology options. Others would however require large capital expenditures which would need to be programmed over a long period of time. Financial constraints may limit the ability of governments to intervene in a significant way to facilitate the implementation of production systems based on the concept of decentralization.

50. Some problems and possible approaches to their solution are briefly discussed below.

Absence of basic infrastructure

51. One of the important factors considered in decisions on the location of industrial production plants is the availability of such infrastructural facilities as water, electricity, transport and communications services. They are essential for the production process itself, and also for the marketing of the goods that are produced.

52. In most of the African countries, infrastructural and other services are concentrated in cities and other large urban settlements, which in certain countries are only a few. Large segments of many countries lack such services and therefore fall to attract industries when traditional investment criteria are applied. Besides, accessibility to such areas could be problematic. Small and medium-scale entrepreneurs who are, by and large, averse to risk, also tend to locate in large settlements where they can be sure of getting the basic services necessary for their operations and also good accessibility to markets.

53. There are situations where an investment package for a building materials project (for example, for cement or timber products) would include the provision of the basic services needed at a site away from already developed population centres. This would usually be the case for rather large-scale projects, returns on which are large enough to cover repayment costs of services considering that there may be no other consumers of those services.

54. The problem to be addressed therefore concerns the enhancement of the attractiveness of the greater part of the country as investment centres, even if only for small- or medium-scale plants. While this is a desirable goal the realities of the economic situation in African countries point to difficulties in achieving concrete results in the short-term. However, long-term planning based on a recognition of the importance of the building materials industry in the national economy, and explicit reference to its role and investment requirements in national economic development plans could help to improve the investment climate for building materials projects in

the various regions of the country. Long-term planning for the development of the national road network, electricity and water supply systems should be used as an instrument for creating favourable conditions for the achievement of the targets of the national building materials development plan. Attention should also be given to building materials industries in the planning of integrated rural development projects. The needs of such industries would then be a key factor to consider in the planning of those projects.

55. The foregoing considerations notwithstanding, there are some measures which could be taken, where feasible, to overcome some of the locational disadvantages caused by the absence of basic infrastructural facilities. These include:

(a) The use of diesel generators to provide electric power requirements of the plant. This may necessitate the installation of adequately sized tanks to store diesel oil requirements;

(b) The use of diesel-owned machines in the production process;

(c) The use of labour intensive techniques with minimum requirements of electrical power;

(d) Development of energy plantations based on quick-growing plant species to be used as solid fuel in thermal power stations for generating electrical power.

(e) The choice of sites where water from bore holes or nearby stream or river could be utilized. Sites close to existing settlements could be advantageous in this regard.

Market size

56. The viability of a building materials plant depends on, among other factors, the availability of markets for its products. Location in the vicinity of major consumption centres or in areas with easy access by one or more transport modes to such centres is therefore to be preferred. Siting of plants in localities poorly served by the existing transport network is unattractive.

57. Even when good transport services are available, it has to be recognized that for some items of building materials, with low value/weight ratios, like burnt clay bricks, there are maximum economic distances over which they can be transported. The viability of the project can therefore not be sustained if the major consumption centres are outside the range of this economic distance.

58. Fortunately however, the production of some items of building materials lends itself to the use of different scales of technology with different output legels. This means that for some materials there is a possibility to have plants of different sizes to satisfy different market sizes. Thus in rural and small town locations, certain materials could still be produced to serve limited local demands.

59. In planning for the production of building materials based on the utilization of local raw materials resources therefore, consideration should be given not only to conventional plants tailored to the needs of large market centres, but also to plants that could employ small-scale technologies to serve small markets.

60 . It may also be necessary sometimes for governments to help in creating the initial markets for unpopular building materials whose widespread use could, for example, lead to the substitution of imported alternttives. In such cases governments could institute measures to guarantee markets for the materials through a commitment to use them in government sponsored projects, and in the building programmes of national housing development and construction organizations.

Absence of complementary industries

61. Another advantage of locating industries in cities or large market centres if the availability of a large number of other industries where products may be required as inputs for the new industries. At the same time there is the added advantage of easy assess to spare parts and competent mechanics for the repair of broken-down machinery and vehicles. Industries in other locations would tend to maintain higher inventories of raw materials and finished products because of irregularities in transport and supply networks. While this may be critical for some industries, it does not appear to be so for the whole range of building materials that could be produced within the country. This factor may therefore not be crucial in the siting of some building materials industries in rural and small town locations.

62. The planners of building materials production units in rural locations should however take due account of the issues raised by complementary industries and provide for measures that would help to overcome bottlenecks likely to occur during the operational phase of the projects.

Problems relating to availability of suitable technologies

63. The concept of decentralization of building materials production implies, as already noted, the utilization of a range of technologies to suit conditions in specific locations. Thus the use of small-scale technologies based on labour intensive processes would be appropriate in some situations, while in others, large-scale mechanized methods or medium-scale, semi-mechanized methods will be required.

64. Conventional technologies for the production of some materials like cement, steel and glass tend to be so specialized that technology packages have been provided to date by a small number of firms located mainly in developed countries. The choice of a specific technology is usually dictated by the nature of conception of the project and the major group financing its implementation. The availability of technologies for large-scale and also medium-scale production of variety of building materials does not usually pose serious problems. Problems, however, arise when wrong choices are made. Suitable criteria for the selection of production technology should therefore be formulated and enforced. Appropriate technologies for the small-scale and handicraft production sector however require attention with regard to their development and use in the context of African countries.

65. In a number of African countries there has occurred the phenomenon whereby following the introduction of cement and other modern materials, there has been a gradual disappearance of handicraft units producing materials such as burnt bricks and roofing tiles in rural and peri-urban areas. The basis of traditional small scale technologies, applied mainly in the informal sector, has therefore been eroded in such countries. The impact of this phenomenon seems to have been more marked in the countries where the production methods employed in these units had been introduced particularly by foreign settlers during the colonial era. In the countries where

handicraft production methods are still practised, inefficient production systems and poor quality products hamper the growth of this production sector and limit its potential to contribute significantly for the supply of building materials required, specially by the formal construction sector.

66. The problems of technology availability can be summed up as the need for small-medium-, and large-scale technologies that can be sustained by a country's level of social, economic, technological and manpower development so that their continued application and maintenance can be guaranteed. The following measures are among those that need to be given attention to minimize the problems posed by production technology.

(a) Planners and decision makers should assess the consequences of available technology options considered appropriate and evolve measures to ensure the successful application of the chosen technologies. Such measures might include the strengthening of the training component of specific projects or planning for adequate technical back-up services.

(b) In negotiations on building materials projects for which external financing is sought, a careful examination of the technology component should be undertakin to reduce the risks of failure during the operational phase of the projects. In the countries where the expertise for such evaluation exercises are lacking, local capacities would have to be built up either within the national planning office or in some other local organizations.

(c) Local capacities for technology development and adaptation in the building materials sectors should be built up or strengthened. Emphasis should be on small- and medium-scale technologies with such levels of mechanization as can be sustained without recourse to external expertise for long-term operation and maintenance.

(d) Concerted efforts should be made to reintroduce lost traditions of small scale building materials production in rural and peri-urban areas. The success of such efforts would depend on the participation of the private and informal sector. Governmental support through the introduction of improved production techniques and management practices that will ensure efficient operations and better quality products as well as back-up services involving research and development, pilot and demonstration projects and technical assistance, would also be necessary.

Energy considerations

67. Building materials industries, in general, consume large amounts of energy (fuel and electricity). The traditional sources of energy have however become expensive in recent times and in many African countries energy could be considered as a scarce commodity. In rural areas of forest zones, firewood has traditionally been the major source of fuel, not only for domestic use, but also for handicraft units producing building materials.

68. Energy supply in rural and remote locations is increasingly becoming problematic due to poor accessibility which hinders the supply of oil products (these products have also become expensive as a result of successive price increases on the world market), absence of electrical power generating facilities or connections to the national power grid, and also due to dwindling firewood supply. Building materials plants located in such areas are therefore likely to face severe problems in maintaining sound operation schedules.

69. In the light of the above problems, new approaches to meeting energy needs in rural and remote locations for uses including the requirements of building materials industries have to be examined for possible implementation. In this connexion, the concept of energy plantations based on the systematic planting and raising of some quick-growing plant species deserves critical examination. Such plantations would not only provide solid fuel for use in thermal power stations for electrical power generation, but could also provide fuel for use in building materials plants based on firewood. Besides, timber is a renewable resource.

70. Among the advantages of energy plantations are the following:

(a) They could make a sizeable contribution to the growing energy needs of a nation and to that extent lessen the energy crisis;

(b) Transportation of fuel resources could be reduced to a minimum and power generation could be decentralized which would help to develop the rural economy.

71. Another source of energy that could be developed to meet needs in rural areas is from micro-hydroelectric plants. In areas with suitable rivers and rainfall these plants could offer opportunities for producing power for small industries and domestic use at costs comparably lower than are possible with other alternatives. Governments should initiate studies to assess the opportunities for the construction of micro-hydro power plants, and formulate programmes for further actions where necessary, including the development of pilot schemes.

72. The following measures should also merit careful consideration by government planners, decision-makers, and industrial promotion organizations:

(a) Establishment of quick-growing timber plantations as integral components of building materials production schemes;

(b) Utilization of agricultural residues like rice husk, bagasse, groundnut shells and saw dust as fuel for materials production should be investigated. Use of rice husk for brick burning has been tried in India. Studies on the use of these fuels should be undertaken in the context of the situation in African countries;

(c) Development and introduction of less energy intensive or more energy efficient materials production technologies;

(d) Development and application of techniques for utilizing solar energy in building materials production.

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PLANNING OF DECENTRALIZED PRODUCTION SYSTEMS

CHAPTER I

PLANNING OF DECENTRALIZED PRODUCTION SYSTEMS

Basic data for planning production systems

Natural resources

1. It is important to have ad some information about the raw material situation in the country in order to determine the possibilities that exist for producing building materials locally. Information on clay, limestone, gypsum, natural pozzolans, mineral ores, gravels, etc., organiz materials - timber and other forest products, as well as industrial and agricultural waste materials, should be known. Informat on on energy resources will also be required. It is not possible to have complete information about the occurrences of these resources, neiteer is it really desirable. Details like the extent of deposit, average thickness of overburden, average thickness of deposits and their yield, and the position of the water table would be necessary when studies aimed at the eventaal extraction of particular raw materials are being undertaking. The available information may therefore be in varying degrees of detail depending on the regular programme of work of the agencies responsible for surveying the deposits and the stage of implementation of decisions regarding the exploitation of specific resources.

2. Geological survey departments have been set up, within the ministries of Mines, Lands or Natural Resources, in many countries. Greater emphasis is however, often placed on the evaluation of mineral ores highly prized on international raw material markets. Very often, therefore, existing geological maps lack information on resources that could be developed for the manufacture of building materials. This situation has to be rectified, where it exists, and specialist teams for the identification, testing, and evaluation of building raw materials should be set up.

3. In countries where geological survey departments do not already exist, steps may have to be taken towards that end, probably on the basis of a project or study initiated with external expert assistance. Mobile units comprising simple drilling equipment and laboratories, appropriately staffed and equipped to carry out the geological search and mapping will be an adequate starting point in some countries. Preliminary information on some raw materials might be obtained from an examination of materials used in traditional construction in various parts of the country, as well as information from local residents about sites where some building materials were produced in the past.

4. Information on timber and other organic materials should normally be available from the offices responsible for forestry and agriculture.

5. Building materials research institutes and testing laboratories, where they do exist, could play useful roles in the detailed evaluation of the suitability of available natural resources for exploitation in building materials production.

Production and consumption of building materials

6. Trends in the production and consumption of different types of building material could be useful as a basis for determining what the future patterns would be. This data is however sometimes difficult to obtain and in several African countries

precise figures are not available. Information on production output in modern industries mass-producing materials like cement, burnt bricks and sanitary ware, as well as other industries registered with the Ministry of Industry may be readily available. However, there are usually large numbers of small industries, some unregistered and scattered in both urban and rural areas, that may be producing a variety of products, and a large statistical service will be required to keep track of their activities, a task which is not easy to undertake. Efforts should however be made to obtain as much information as possible within the limits of the constraints posed by financial and manpower resources. One approach would be to make it compulsory for manufacturers to submit returns on their production output as a condition for the renewal of their licences. Sample surveys conducted by the Ministry of Industry and mail questionnaire surveys have been used with sarying degrees of success.

7. Compilation of data on consumption of various items of building material will be facilitated by the availability, in addition to data on production, of data on imports and exports of the different materials. Statistical data on production, imports and exports are usually collected and published by the national bureau of statistics. It is important that such publications are kept up to date so that their usefulness for planning purposes might not be diminished.

8. The distribution of consumption of materials in different regions or locations of the country should be determined. For materials which are handled by designated distribution organizations it should not be too difficult to obtain the information on the quantities sold in different geographical locations. This type of information would be useful when plans for the development of alternative or substitute materials are being formulated.

9. An estimation of the consumption of building materials in different types of construction would assist in making reliable estimates of the effect on total consumption of changes in the composition of construction output and show the possibilities of interchanging materials.

Future production and consumption

10. The estimation of the future demand for and the production of different items of building materials provides a basis for assessing the future gap between supply and demand and designing strategies to make up for the anticipated shortfall in supply. Estimates of future demand also serve as a guide to the management of existing materials industries in planning the expansion of production lines and the introduction of entirely new lines to meet market demand for materials whose production was hitherto considered uneconomic. Information on past trends is often used as a basis for estimating future production and consumption patterns.

11. In many African countries forecasts of future production in some of the existing plants present problems because of uncertainties about production inputs and the state of repair of production machinery and equipment. This is specially true of capital intensive plants which depend on imported raw materials and spare parts. In such cases the reliance on past trends to forecast future levels without any adjustments would yield erroneous results.

12. Attempts have been made to statistically relate per capita consumption of some materials like cement, steel, sawn timber and wood-based panels to the gross national production and the gross domestic capital formation. The relevance of this kind of analysis as a basis for forecasting in African countries is not certain. This is

because factors like import restrictions, acute shortages and artificially high market prices, etc. have the net effect of suppressing and distorting consumption. There is also the difficulty of determining, for some materials like steel, wood and wood-based products, and plastics, the proportion that is used in construction rather than in other applications.

13. Irrespective of the method of forecasting that is used, it is important to take note of certain factors and changes which could influence the volume and composition of demand for building meterials. These include the following:

(a) Major public construction projects like dams and irrigation schemes generate large but short-term demands for building materials and would necessitate additional imports or severely slow down the pace of other construction projects by creating shortages of materials. Government projects that are in the pipe-line should therefore be carefully scrutinized to determine their probable impact on the building materials market;

(b) The pattern of use of building materials in different types of construction. There could be changes in these patterns as a result of specific policies directed at the promotion of the use of certain materials in place of others whose use in certain types of construction is to be discouraged. It is important to take note of such policies and estimate their effect on future patterns of materials useage. For example it may be government policy to encourage the use of burnt bricks for wall construction in specified types of buildings instead of sandcrete blocks.

14. The major problem associated with the determination of furure production and consumption patterns in many African countries is the lack of a sound statistical data base. This is an area which should receive priority in the planning process for building materials development.

Choice of building materials for local production

15. The materials required in construction may be classified into four main categories by end use: foundations and walls, roofing, fixtures and fittings, and finishes. The historical development of the building materials industry in several countries worldwide has shown an emphasis on the manufacture of walling materials in the early stages of development, followed by the manufacture of roofing and flooring materials and components even if all the essential raw materials were available locally. For example, even the minimum economic plant size for a particular material may be too great for the national demand and unless guaranteed export markets can be found, local production cannot be undertaken.

16. Generally then, the selection of building materials for inclusion in the national building materials development plan would depend primarily on the following factors:

(a) Ready availability of raw materials and other factor inputs. The setting up of plants that would depend heavily on imported raw materials should be given careful scrutiny. Examples abound in African countries of the failure of such plants mainly because of chronic foreign currency constraints;

(b) Size of markets. Information on the local and national demand (and external

demand where export is envisaged) for various building materials and its distribution, as well as the likely future trend should be known. The constraints posed by inadequate transportation networks on distribution should be noted;

(c) Marketability of products. It is clear that if there is an established demand for a specific material, and it is manufactured to acceptable standards, it should not be difficult to market it, assuming that the price is affordable. Cases will however arise where Governments would wish to promote the introduction of new materials into building practice in the country. In such cases, decisions on the production of the materials will have to be coupled with measures aimed at creating markets for the materials, for example, a commitment to use them in planned government-sponsored building programmes;

(d) Climatic and environmental factors. These may warrant decisions on production of specific building materials to meet local needs. For example, in hot dry climatic zones the development of stone and burnt clay products for walling would be desirable from the view point of thermal comform in buildings,

(e) Export potential. The potential for earning foreign exchange through export will be an important criterion specially in the case of materials for which the minimum economic plant size is bigger than the requirements of the national market.

17. With the foregoing considerations in view, a detailed study of the prevailing conditions in each region of the country should be undertaken. The objecti e should be to come up with a list of materials whose production could be considered in a future plan. Within the broad framework provided by the preliminary list of production possibilities, specific decisions could be taken based on accepted investment criteria.

18. Production possibilities for walling materials and binders that should be accorded increasing priority include: burnt clay bricks and blocks, building stone, stabilized soil bricks, gypsum, lime, pozzolana and lime-pozzolana. While a number of countries have plants for the production of portland cement, it should be noted that conventional cement plants (minimum capacity about 2,000 tonnes per day) are far greater than the demand in several countries. The establishment of conventional plants in some countries would therefore not be feasible unless there are guaranteed export markets. There are however prospects for the introduction of mini-cement plants with capacities of upto 200 tonnes per day.

19. The potential for the production of pozzolana has not been exploited in several countries. Pozzolanic materials can be used as partial replacement of portland cement (upto about 40 per cent) without adversely affecting the properties of the resulting cement. They can also be mixed with lime to produce a cementitious binder. Natural pozzolana deposits are found in some countries. Artificial pozzolana could be produced from clays, bauxite waste and rice husk. Ashes from the burning of rice straw, dried banana leaves and bagasse are also reported to have shown good pozzolanic properties.

20. The most popular roof coverings for housing and building construction in urban areas are galvanized corrugated iron, aluminium and asbestos-cement sheets. These materials are essentially imported items and even in countries where they are produced locally, there is still a high foreign exchange cost component. Alternatives that should be investigated are clay roofing tiles, wood shingles and sheets made from cement and natural fibres, like sisal fibre.

Choice of production technology

21. The choice of technology is traditionally based on technical and economic considerations - that is, the chosen technology should be that which is able to produce the required output in the most economical manner. It has already been pointed out that for building materials projects for which there are foreign technical partners, and for which foreign exchange costs are met by loans from external sources, there is usually little flexibility in the choice of technology. This seems to be a major feature of the majority of large-scale capital intensive plants that have been set up in the countries of the African region.

22. The tendency to associate capital intensive technologies with modernity and low-capital, labour-intensive technologies with backwardness or retrogression, should be discarded in favour of a realisitc appraisal of the available technology options in the light of a country's economic and social development goals and the reality of prevailing conditions. Thus, possibilities for promoting building materials production in rural areas, for example, should not be rejected because there are no suitable "modern" technologies for the levels of production envisaged.

23. In the context of African countries, the majority of which face severe balance of payments problems, the minimization of the outflow of scarce foreign-exchange should become an important criterion in technological choice. This criterion, taken in isolation, would generally favour the adoption of labour intensive technologies. For some production processes, for example for sheet glass, suitable labour intensive technologies cannot be identified.

24. A set of criteria for technology choice in implementing the national building materials development plan should therefore be identified. The weight accorded to each criterion in decision-making should reflect the political, social, technical and economic conditions in the country. The primary objective should be to select the most appropriate technology for any given situation. The following suggestion is made on criteria that should be accorded priority:

(a) Technical and economic considerations - efficiency of production, quality of products, and maximization of returns on investment;

(b) Minimization of outflow of foreign exchange - consideration should be given not only to the capital outlay for initial purchase of machinery, equipment and materials from overseas but also to long-term purchases of spare parts, materials and salary transfers for expatriate staff;

(c) Employment generation potential - high levels of unemployment and underemloyment in African countries make this an important consideration;

(d) Sustainability - the extent of availability of local technical and managerial skills, repair and maintenance services that will ensure continuous operation of the plant during the period of its economic life;

(e) Potential for stimulating local development of technology including linkages in the form of fabrication of plant, machines, tools and spare parts.

Assessment of infrastructural facilities

25. The absence of adequate infrastructural facilities such as roads, water and electrical power supply poses serious constraints on the implementation of planned projects for the establishment of industries. The problems are more severe in rural

areas which are usually underserved by such infrastructure in many African countries.

26. In studying the raw material deposits that have great potential for supporting building materials plants, therefore, an appraisal should be undertaken of the extent to which prospective project sites are served by basic infrastructural facilities, of planned programmes for supplying the sites with infrastructure, and the additional requirements for infrastructural facilities which may have to be incorporated into the design of projects for the production of building materials.

27. The office responsible for the preparation of the building materials development plan should liaise closely with the Government ministries, departments and offices that are concerned with the provision of utilities and other infrastructure. Knowledge of the future programmes of these agencies would help in scheduling the programme for the implementation of building materials projects. Agreements could also be reached on the incorporation of the infrastructural needs of building materials projects in special development schemes such as integrated rural development schemes.

Manpower needs

28. Qualified technical and managerial manpower, as well as entrepreneurs with the drive for initiating and pursuing investment activities constitute a critical component in any strategy for achieving a greater measure of local self-sufficiency in building materials supply. In discussing the current situation of the building materials industry in Africa (Chapter I), it was pointed out that the lack of competent technicians and managerial personnel has contributed to the poor performance of plants set up in the past. Dependence on expatriate staff in the early years of plant operation without carefully planned programmes for training nationals to take over after the departure of the former led to operational bottlenecks.

29. In view of this past experience, it becomes necessary, as part of the planning process, to review the current situation regarding manpower in the building materials production sector and to plan for future needs. The following aspects should be covered in the review exercise:

(a) Analysis of the problems concerning different categories of manpower in terms of availability, competence (level of training and experienee) and factors affecting their productivity based on a sample survey of existing production units;

(b) Assessment of training facilities and schemes, if any, operated by the management of existing building materials production units for their personnel;

(c) Assessment of institutional facilities available within the country for training the categories of manpower required by the building materials production sector - technical colleges, polytechnich, vocational training centres, management training institutes, etc. The output of the training institutions, both present and planned, should be noted;

(d) Study of proposed or approved plans for the establishment of training institutions which are likely to generate trained manpower for the building materials industry.

30. In order to be able to plan effectively towards reducing the gap between the supply and demand of manpower for the implementation of building materials projects,

an estimate should be made of the number of personnel of various categories likely to be needed for projects included in the national building materials development plan. The kind of training required to meet the needs of each category should also be defined. In countries where there is an active private sector, it would generally not be easy to forecast the future manpower requirements for that sector since projects generated by it are not subject to co-ordinated planning by a centralized agency. Past experience could however be used as a guide in making estimates for this sector.

31. It would be difficult to plan separately for meeting all the manpower requirements of the building materials industry based on anticipated gaps between supply and demand, given that existing public training institutions normally, cater to the needs of the industrial sector as a whole. In general, therefore, a programme for meeting the future labour needs of the building materials industry would constitute a component in the overall national manpower development plan. This particularly true of categories like welders, electricians and mechanics whose skills can be utilized in industries other than building materials.

32. Special centres could also be set up to train manpower for specific building materials industries like cement, brick and tile, wood and wood-based products, etc.

33. In the small-scale industries sector where there is greater dependence on the skills of the personnel rather than on the equipment used, the quality of persons engaged in management and production is crucial for achieving successful operations. The entrepreneurs, who invariably become the managers of businesses in this sector, very often lack the skills and expertise required to establish and maintain sound production enterprises. One of the important activities of the lead agency responsible for the promotoon of small-scale industries, including those in the building materials industry, should be the design and implementation of suitable training programmes for improving and upgrading the skills of workers and managerial personnel, and for transfering production technologies.

34. The nature of training programmes adopted will depend on specific local needs in various countries. Training methods which have been used in some countries by industrial promotion organizations include the following:

(i) Operation of training centres where clurses where atter the basic training programme trainees are offered the opportunity to be involved in actual production activities relating to their field of interest, for example

(ii) Operation of training cum production centres where after the basic training programme trainees are offered the opportunity to be involved in actual production activities relating to their field of interest, for example brickmaking, lime production, carpentry, etc.

(iii) Organization of seminars and workshops;

(iv) Arranging training, both locally and abroad, in other establishments. Attachment training could be arranged for entrepreneurs in production establishments which utilize the technologies that the entrepreneurs expect to adopt in their own plants;

(v) Undertaking model projects to demonstrate small scale production capabilities.

35. A high percentage of workers in the building materials industry fall within the semi-skilled and unskilled categories. For this group of workers extensive training is usually not required, and on-the-job training is sufficient to enable them to perform their duties. Problems are however very often experienced in finding skilled workmen like carpenters, mechanics, electricians, etc. and also supervisory, technical and managerial staff.

Preparation of building materials development plan

36. The preparation of a plan for the systematic development of the building materials industry is indispensable if progress is to be made towards meeting the requirements of the construction industry for building materials in terms of quantity and quality. The type and extent of detail of plans that could be prepared would be governed by the models on which the whole economy is generally planned. There are however some guidelines which would be applicable to the different planning models that may be adopted, and therefore, should be kept in view:

(a) The goals and targets for the short, medium and long-term periods should be clearly defined. These should be realistic and attainable and should take account of anticipated resource constraints;

(b) Priorities for the development of specific building materials should be determined for each phase of the plan period. Materials which require long gestation periods for the establishment of production units would be programmed for the long-term phase, though in practice preparatory work on the projects could start even during the short-term phase;

(c) The plan should identify project possibilities on the basis of natural resources available in each geographical zone (region, district, etc.) and in conformity with the priorities defined above. Local self-sufficiency in some materials will be an important consideration. For some projects of national importance details may already be available on size of plant, product mix, location and technology. Based on the size of the gap between supply and demand levels, and changes in the patterns of use of materials in different types of construction, estimates can be made of the number of new plants that may require to be established in various geographical zones. In such cases realistic numbers should be determined based on the targets set in (a) above. For example, it can be projected that 10 lime plants and 6 brick plants will be established during the plan period;

(d) While it is relatively easier to be precise with regard to projects to be undertaken by public sector organizations, one cannot be precise about the projects that are likely to be taken up by the private sector. However, if the role of the private sector in the development of building materials industries is clearly spelt out in the government's industrial development policy, targets could be set for that sector and measures taken, during the plan implementation period, to attract the participation of the private investor;

(e) The modalities for achieving higher capacity utilization rates in existing building materials plants should be clearly spelt out. Rehabilitation and upgrading programmes with the objective of increasing installed capacities should also be indicated;

(f) The implications of planned projects in terms of cost, technology, energy, infrastructural facilities, trained manpower, etc. should be determined and the modalities for overcoming the consequences of these implications should be outlined. This matter is discussed further in Chapter V;

(g) The plan should help to promote the deventralization and diversification of materials production to ensure the timely availability of building materials for construction projects in all geographical zones of the country;

(h) The plan should be amenable to periodic review based on the monitoring of its implementation.

Machinery for the co-ordinated planning and development of the building materials industry

37. Several ministries and institutions in the public sector undertake activities that concern the development of the building materials industry. The Ministry of Industry is the government ministry with primary responsibility for defining policies and setting out general guidelines for the establishment of building materials plants. However, other ministries like Works, Housing, Natural Resources, Forestry, Rural Development, Planning, etc. exercise functions relating to the production and use of building materials. There is need in several African countries for a central machinery that would ensure a comprehensive and co-ordinated approach to the planning and implementation of programmes for the development of the industry.

38. Three options could be examined with regard to the creation of such a machinery:

(a) Establishing an inter-ministerial/agency/institution co-ordinating committee with membership from concerned bodies;

(b) Entrusting responsibllity for the co-ordinating functions to an existing competent institution;

(c) Establishing an independent Building Materials Development Secretariat under a concerned ministry or office.

39. The functions of the co-ordinating machinery could include the following:

(a) Generally advise the Covernment on measures and policies for promoting the bullding materials industry taking account of the need for decentralization and diversification of production, the choice of appropriate production technologies, mobilization of finance, etc.;

(b) Facilitate and encourage collaboration among government agencies, parastatals and other bodies concerned with the building materials industry in order to promote the setting up of production units and the rational use of materials in construction;

(c) Advise the government on appropriate policies and measures for promoting rationalization of building material useage including the adoption of proven materials and techniques developed from local resources;

(d) Compile, analyse and publish statistical, technical and other information such as may be required for preparing plans or formulating policies regarding the industry,

(e) Facilitate or co-ordinate assistance to entrepreneurs wishing to set up building materials plants;

(f) Promote the carrying out of research and the "commercialization" of research findings;

(g) Promote information, standardization and regulatory activities for enhancing the use of materials in construction.

CHAPTER II

IMPLEMENTATION OF PROGRAMMES AND PROJECTS FOR THE ESTABLISHMENT OF BUILDING MATERIALS PRODUCTION UNITS

Basic requirements

42. The implementation phase of programme and project development is as equally important as the planning phase and its requirements should be carefully anticipated, and incorporated into the plans prepared in order to ensure the achievement of the anticipated results. Failure at the implementation stage could well be a reflection on failure to produce a realistic and attainable plan. It is also true that the best plans would olly remain ideas on paper unless concrete steps are taken to provide the required resources and environment to ensure that they result in operational projects.

43. A review of the rate of achievement of national development plans in several African countries would show a sizeable gap between the anticipated targets in various economic sectors and the actual results achieved. A number of factors could be cited as having contributed to this state of affairs: setting of overly-ambitious targets without reference to available resources; failure to mobilize adequate financial assistance and other incentives to projects in some sectors; absence or inadequacy of infrastructural services like technical consultancy, research and development, training and extension services; lack of technical assistance and information services; poor co-ordination and monitoring mechanisms.

44. The following and other related questions should therefore be asked and adequately answered if programmes and projects planned in connexion with the search for a viable building materials industry capable of meeting the requirements of various kinds of building materials in different locations across the country.

(a) Are the targets set out in the building materials development plan realistic and attainable, having been based on a careful appraisal of available resources?

(b) How are funds to be mobilized from both public and private sources to ensure the smooth implementation of projects for the setting up of production units? Are there any incentives that could be devised to induce entrepreneurs to invest in building materials projects included in the plan?

(c) Are there adequately developed technical back-stopping services to assist public enterprizes and private entrepreneurs? For example, if an entrepreneur decides to set up a small scale plant for the production of burnt bricks, are there offices he could contact for assistance, and advise on such matters as size of production unit, suitable production technology, sources of supply of machines or tools, sources of finance and process of acquiring funds from such sources, etc., etc

45. These topics form the subject of discussion in the remaining part of this chapter.

Institutional support

46. The successful implementation of the national building materials development plan is dependent on the existence of competent institutional machineries for monitoring the rate of implementation of different phases of the plan, evaluating constraints to plan implementation and devising remedial measures, providing guidance and assistance

on administrative and legal procedures for investments in industrial projects, providing technical and financial assistance to investors in building materials projects. The experience of several African countries indicates that these functions are normally carried out not only by one institution, but by a number of institutions including government ministries, investment development and promotion centres, and industrial development banks.

45. Irrespective of the mix of institutions set up to assist investors in building materials projects in the manner described above, steps must be taken to ensure that the following aspects are covered sufficiently:

(a) Provision of technical assistance and guidance with respect to: preparation of project studies and feasibility reports; guidance on sources of production technology and selection of plant size and suitable technologies including machinery, plant and equipment;

(b) Assisting entrepreneurs to secure the services of other organizations for resolving some of the problems relating to the setting up of a building materials production unit, such as evaluation of raw material reserves to determine their quantity and suitability for production process;

(c) Facilitating access to funding sources and funds both local and foreign, and granting incentives that would help to attract investments in building materials projects.

(d) According priority to the monitoring of the implementation of projects in the building materials sector as a continuing exercise. This would help to identify bottlenecks emanating, for example, from lack of production inputs, suitable technologies and related equipment, finance, skills, etc. The importance of programme and project monitoring cannot be overemphasized.

46. The special needs of small-scale building materials industries in respect of institutional support are discussed separately below. The role of other institutions necessary for the successful implementation of programmes aimed at the decentralized production of building materials such as research, information and training institutions is also discussed later in this chapter.

Small-scale industries development organizations

47. The problems of entrepreneurs in the small-scale industrial sector need to be accorded special attention. Most of the existing industrial promotion organizations concentrate their activities on medium and large scale projects. However, as has already been pointed out some countries in Africa have set up industrial development organizations to deal with the special pooblems of small-scale industries. Existing organizations in the small-scale sector would have to strengthen their activities relating to building materials industries. In countries where such organizations do not already exist, the governments should investigate the feasibility of enlarging the mandate of existing industrial development or promotion organizations to cover small-scale building materials industries or else consider the creation of suitable organizations for that purpose.

48. The functions of organizations for promoting small-scale industries (including building materials industries) should include the following:

(a) To plan and coordinate the activities on small-scale industries and undertake such measures as would promote their orderly and balanced development;

(b) To provide technical assistance to small-scale industries including: identification of products to be manufactured, preparation of project reports and feasibility studies, selection of production technology and related machines and equipment, project implementation;

(c) To provide extension services on management, technical problems, marketing and accounting;

(d) To provide or assist in mobilizing financial resources for the establishment of industries in the small-scale sector;

(e) To undertake or promote research geared to the development of small-scale industries including technology development, standardization and quality control, management techniques, marketing strategies, etc.

(f) To provide and promote training facilities and programmes for entrepreneurs or employees of small-scale industries and to assist and co-ordinate the activities of other institutions engaged in such training.

Incentives for building materials production

Direct incentives

49. The building materials industry, as part of the general manufacturing sector, benefits from various promotion measures instituted by governments as part of the strategy to encourage and attract investments into industrial development projects. These measures, which unintentionally favour the establishment of large-scale and capital intensive firms include:

(a) Tax holiday for specified time periods (usually 5 to 10 years);
(b) Investment allowances or subsidies;
(c) Capital allowances over and above normal depreciation allowances;
(d) Reinvestment allowance;
(e) Exemption from customs and excise duties on equipment, machinery and raw materials;
(f) Guarantees on repatriation of capital and profits.

50. The nature of investments in building materials projects is such that short-term returns tend to be generally lower than can be obtained from other sectors, and thus may not be attractive to entrepreneurs. Erratic market fluctuations also increase the risk factor in such investments. In addition to the incentives listed above, governments should consider other measures which would help to create a more favourable investment climate for the establishment of new building materials plants and the expansion of existing ones.

51. These measures could include the following:

(a) Granting long-term low interest loans and facilitating access to such loans;

(b) Assisting public manufacturing enterprises through subsidies and grants;

(c) Providing land at concessionary rates, and supplementary basic infrastructure including access roads to production sites. Development of industrial estates should be explored;

(d) Providing guarantees for import of basic machinery and equipment specially by private-sector investors;

(e) Protecting plants producing items of building materials against unfavourable competition from imported substitute materials through import restrictions and taxes on imported materials.

Indirect incentives

52. Some of the materials to be promoted within the framework of a decentralized production system utilizing locally available raw materials would be relatively unknown on the building materials market. The increased production and use of such materials will therefore depend greatly on the breaking down of psychological barriers founded on conservatism and sometimes unrelated directly to their technical performance characteristics. The formulation and enforcement of quality standards and testing controls for such materials, and the government's commitment to use them in government-sponsored projects would contribute greatly in enhancing their increased use in both public and private housing and building projects, thereby ensuring an improved market for the output of production units that would be set up.

53 The use of demonstration housing projects to establish the credibility and technical viability of less-used building materials has been a very popular concept. Experience has however shown that several demonstration projects have failed to make the expected impact primarily because of the approaches used and the absence of follow-up in the use of such materials in public housing and building projects. The idea of promoting some materials for use by the "poor" has very often generated negative impressions about their suitability for decent and durable building construction. It has already been stressed that governments have a vital role to play in creating markets for 'new' building materials. Practical examples of the use of materials in government housing projects, for instance, can help greatly to remove common prejudices about such materials. The confidence of public construction agencies, as well as contractors and builders, in new building materials will be enhanced by the existence of building legislation such as building codes, standards and regulations which give due recognition to the application of such materials in building practice. Governments have to give high priority to the reformulation of existing building legislations, which, in most African countries, act as hindrances to the increased production and use of some building materials and components.

54. Other measures that could help to stimulate investments in building materials production units include the development of building research centres and materials testing laboratories, the promotion of standardization and quality control activities, and the creation of an adequate base of information, trainnng and extension services.

Financing of building materials projects

55. Adequate financial support is crucial for the realization of plans to improve the supply of building materials through local production. A number of building materials production units exist in African countries which were set up as joint ventures, with

the foreign exchange component of investment costs financed by foreign partners while the local cost component was financed by the national governments and/or private entrepreneurs. Such plants have been almost always in the large-scale capital intensive category. While this mode of financing has contributed greatly to the realization of vital materials projects, it may also have contributed to the operational problems experienced by some of the plants that have been constructed. The technology component and the related machinery and equipment are usually the products of companies of the foreign technical partner and this places a constraint on the choice that can be made. The existence of competent national consultancy services capable of evaluating project investment proposals could, however, help in minimizing the technical operational problems that could arise in connection with this type of joint venture.

56. Many countries would still find it advantageous to encourage foreign participation in the establishment of building materials plants. The nature and scope, as well as the measures instituted to attract such participation should be clearly defined and publicized. The assistance of international financial institutions and bilaterla funding agencies should be sought for the implementation of high cost projects for strategic materials such as cement, iron and steel products, and glass. Participation in joint ventures with neighbouring countries for the production of materials for which national markets are inadequate to sustain the minimum economic size of production should be encouraged in the cases where economic, financial and technical feasibility can be established.

57. Experience in some countries has shown that assistance could be mobilized for small-scale industries through international co-operation arrangements with developed and developing countries in other regions. In this way funds, machinery, equipment and technical expertise could be secured in support of programmes and projects for the establishment of small-scale plants.

Mobilization of funds from local sources

58. It is not always easy to find foreign collaboration for building materials projects and long gestation periods result in escalation of project investment costs. This situation calls for the effective mobilization and use of financial resources available locally to meet the needs of building materials industries.

59. The traditional sources of funds for building materials projects are the development finance institutions like industrial development banks, national investment banks and specialized housing finance banks. Investments in building materials projects are however not very attractive, particularly from the point of view of the private investor because of lower returns and relatively long cost repayment periods, high initial capital outlay (for capital intensive projects) and demand uncertainties resulting from fluctuations in construction output. The need therefore arises to examine the possibility for the granting of long-term loans at interest rates lower than the on-going convercial rates.

60. In some countries where the governments have accorded high priority to the development of small industries, some banks have been authorized to set up special departments to deal with the granting of credit facilities to the small scale industries sector. The lending policies of such departments should be tailored to the specific needs of this sector in order to achieve significant operational results. In order to boost the operations of such banks or financing institutions in the area of small scale building materials industries, governments may have to place, from time to time, special funds or grants at their disposal. Such financial allocations should reflect the government's

recognition of the importance of the building materials sector to the sound development of the national economy.

61. In view of the general scarcity of financial resources at the national level to satisfactorily meet the needs of competing demands in various sectors of the economy, it becomes necessary to re-examine the question of mobilization of funds from the private sector in support of building materials projects especially in the market-economy countries. The private investor generally goes for investment opportunities with potentially attractive returns and low risk factors. Investments in building materials industries, which in general do not appear attractive, therefore have to be rendered attractive enough to elicit the attention of the private investor. Governments have used both direct and indirect fiscal and other measures as discussed above to achiev this objective.

62. Questions relating to the provision of basic infrastructure, the reduction of uncertainties in demand levels and patterns, and the existence of adequate technical back-stopping services aee all important from the point of view of the private investor.

Research and development activities

63. The encouragement of decentralized systems of building materials production based on the rational utilization of potentially useable raw materials in scattered locations would inevitably lead to the promotion of materials that are new to the local building industry, even though some of such materials may have had a long tradition of use in other countries. Building materials like lime, lime-pozzolana and stabilized soil fall into this category. There are other materials like rice husk ash cement, and some types of fibre reinforced panels and sheets which are relatively recent and on which studies are still in progress particularly with regard to long-term performance characteristics and specific areas of application. There also exists the danger of uneconomic use of established materials like cement and concrete in construction projects because of imported design concepts that do not sufficiently reflect local climatic conditions.

64. It is therefore important bo build up local research capabilities to assist in developing the technical base for the manufacture and use of building materials derived from local resources. The functions of a national building/building materials research institution in this respect should include the following:

(a) Undertake studies and provide information about properties and performance characteristics of locally produced building materials to assist in formulation of standards and preparation of design guidelines;

(b) Develop production technologies appropriate to local resource conditions; emphasis should be on technologies that can be applied in small- and medium-scale production ventures;

(c) Provide testing facilities and technical advisory and consultancy services to prospective investors in building materials projects;

(d) Develop design concepts for the efficient and economic use of building materials in building and constructinn in the various climatic zones of the country; special attention should be devoted to materials which are new to the construction market;

(e) Engage in the design of simple plant, equipment and tools that could be commercialized for use in building materials production units;

(f) Generally promote the production and use of building materials derived from local resources through demonstration projects, dissemination of technical information in simplified formats, organization of training courses on building materials production and utilization techniques and provision of advice to builders and designers on choice of materials and techniques.

65. The programme of work of institutions engaged in research on building materials should be aimed primarily at meeting urgent and practical needs. In this connexion, the programme of work should be based on the national plan for the development of the building materials industry with a view to providing technical support for the achievement of the targets in the plan. Other areas of action with respect to research and development activities are as follows:

(a) In some of the African countries where building and building materials research institutes exist, their activities have not always been accorded the priority they deserve. Insufficient financial resources, lack of modern equipment and lack of qualified acientists and technologists have all contributed to reducing their capacity for making a meaningful impact on activities in the building industry. Efforts are needed at the national level to overcome these constraints. The feasibility of setting up a research fund with contributions from the public and private building and construction sector should be studies;

(b) The active involvement of manufacturers, financiers and other user organizations in research planning and programming should be encouraged as a means of mobilizing resources for research and enhancnng the wider application of research findings;

(c) Governments should also iive attemtion to the promotion of joint research programmes with other countries having similar raw material resources, climatic conditions and building and building materials development problems.

66. The sharing of experiences through information exchange should be encouraged to avoid duplication of research effort. For some countries it may be desirable to consider the pooling together of resources for the creation of joint building and building materials research centres. In this way the limited financial and other resources available nationally could be mobilized to undertake the kind of research activities that would make an impact on the development of the local building industry.

Information, training and extension services

67. These three services constitute an important link in the process of technology transfer in the field of building materials industries development. The conventional large scale plants usually involve the application of imported technologies for which personnel are trained both overseas and locally on the job. Experience has however shown that in several cases the technology assimilation has been incomplete by the time of the handing ov r of the plant to the local counterpart team and operational and

management problems have resulted. This raises the question of matching technology choice with the level of local technical expertise and its ability to absorb a given technology over a given time period. Governments must ensure the incorporation of suitably designed and realisitc training components in such project proposals to avoid the wastage of scarce financial resources in projects that would otherwise be unprofitable.

68. The problem of greater concern in this section relates to the provision of the kind of information, training and extension services that would help in the widespread application of technologies for medium and small-scale building materials production throughout the country. It is expected that much of this technology range would have been developed by natinnal research and development nnstitutions or adapted from foreign-developed technologies by such institutions or industrial development organizations, and tested in demonstration projects in the country.

69. Various reasons can be enumerated for the non-adoption of technologies for building materials, as well as, techniques of building construction employing some materials produced from local resources, developed by local research and development institutions. Among them are the following:

(a) Failure of Research and Development(R & D) institutions to adopt an aggresive attitude in marketing their research findings and convincing the public and private sector of the technical and commercial viability of new processes and techniques;

(b) Failure to present research findings in simple technical language and in a form that can be easily understood by the user public;

(c) Absence of regional centres where information and advice on, as well as training in, production and building techniques can be obtained;

(d) Lack of proper guidance on potential investment opportunities and technical assistance to prospective investors.

70. In their programmes to achieve effective decentralized systems of materials production based on suitable technologies, governments would have to assist in removing existing bottlenecks to building materials technology transfer. Solutions could include the following:

(a) Strengthening the capacities of R & D institutions to set up demonstration plants to demonstrate the feasibility of new production technologies and offer training to entrepreneurs;

(b) Encouraging and assisting Research and Development institutions to expand their information and documentation activities, to produce simplified technical literature translated, if possible, into selected local languages, and also to produce audio-visual materials, all for the purpose of facilitating dissemination of relevant information to various target groups;

(c) Setting up building/building materials information centres in accessible locations on regional/district basis where prospective entrepreneurs can botain simplified technical literature on production methods, see samples of materials that can be produced by using the technologies being promoted and also request advice on the modalities of setting up a production unit. Such centres could be set up as extension

wings of R & D institutions or industrial development organizations but in some countries it may be thought expedient to set up the centres as separate organizations within a concerned government ministry. Irespective of the type of organizational structure adopted, there should be close collaboration among the R & D institutions, the industrial development organizations dealing with building materials development and the building/building materials information centre.

(d) Organizing extension programmes whereby entrepreneurs would be given practical assistance in the setting up of production units covering such aspects as: design of plant lay-out and production system, installation of machines, training of workers in production process, organization of accounting and management procedures, etc. This function could be carried out by the industrial development organization in collaboration with the concerned research and development institution.

71. The ultimate objective of all the measures discussed above should be to facilitate a prospective entrepreneur's access to the information that the needs to make a sound decision on an investment in a building materials plant and to provide the assistance he needs to set up and operate a plant which will bring him a reasonable return on his investment. One positive effect of the success of entrepreneurs in this way would be the saving of foreign exchange which could be used to meet the import needs of other sectors of the national economy.

Local fabrication of machines, equipment and tools

72. The successful development of a viable and self-reliant building materials industry based on a mix of small-, medium-, and large-scale production units depends on, among other factors, the creation of local capacities for the fabrication of simple machines, equipment and tools required for the setting up and operation of the production units. This is particularly crucial for the promotion of the widespread adoption of locally developed (or adapted) production technologies. The fabrication of spare parts to satisfy the needs of existing plants, specially those based on imported technology for which, because of foreign exchange constraints, spare parts cannot be imported regularly to undertake maintenance and repair operations, would help to boost production in some of the plants.

73. There exist already in some countries facilities, with varying degrees of capability, for the manufacture of machines, equipment and tools for the agricultural sector and also for some sectors of industry. Some of these capacities have developed as an off shoot of the activities of engineering workshops of training institutions (technical schools and colleges, vocational training centres, etc.), service and manufacturing companies (Railway authorities, Mining and Steel Companies, etc.). In some cases companies have been set up for the express purpose of fabricating much needed machines and equipment particularly for the agricultural sector. In addition there are mechanical workshops in the informal sector where items of equipment and tools can be fabricated in accordance with specifications supplied by a client. Problems of poor quality products are however common with such workshops.

74. Governments need to evaluate the potential that already exist at the national level and evolve long-term strategies for strengthening the country's facilities and capabilities with regard to the fabrication of machines and equipment for the building materials industry. The actions that are required, in this connexion include the following:

(a) Undertaking an assessemnt of the capabilities of engineering and metal work-

shops, both in the formal and informal sectors, in relation to the fabrication of various items of machines, equipment and tools. The assessment should cover both the items that are currently produced and those that could be produced if a demand was established;

(b) Preparing a long-term plan for the development of facilities and expertise for machine and equipment manufacturing industry including the setting up of machine shops, foundries, forging and heat treatment shops. The development of skilled manpower and provision of specialized machinery, equipment and other inputs should be stressed in the plan;

(c) Designing a programme for upgrading and strengthening the existing facilities at selected workshops in technical colleges and public enterprises to improve their capacities for fabricating machines and equipment, particularly for the building materials industry. This approach may be adopted as the first step in the process for setting up full-fledged machine and equipment manufacturing centres;

(d) Preparing a programme of assistance to engineering workshops in the informal sector which have great potential for contributing to the achievement of the targets of the long-term plan (see (b) above). This programme should take account of the possibility of grouping some of the workshops into co-operatives as a means of enhancing their efficient operations. The provision of loans under favourable terms and assistance in securing specialized production machinery and equipment would be essential for the success of this programme;

(e) Seeking assistance from bilateral funding sources in the form of machinery, equipment, funds and expertise for the implementation of the long-term plan referred to in (b) above;

(f) Encouraging investments by the private sector in facilities for fabricating machines, equipment and tools by granting suitable incentives.

CHAPTER III

GENERAL POLICY MEASURES

75. The foregoing discussion has drawn attention to the important role that national governments are called upon to play in providing a sound base and the conditions favourable to the organized and coordinated development of the building materials industry, keeping in view the need to utilize all potential resources within the framework of a decentralized production system. Reference has been made, in several sections of the document, to some of the policy measures that need to be taken by governments in that connexion. This chapter provides a summary of some of the main policy measures.

76. The need to achieve an increasing measure of self-sufficiency in the building materials industry is generally recognized by the Governments of the countries in the African region. This recognition should be backed by a renewed political commitment which should be translated into concrete measures that would promote the development of the industry. The following measures should be stressed:

(a) Giving due recognition to the importance of the building materials industry in the national economy and ensuring that its needs are explicitly catered for in national short-term and long-term development plans;

(b) Creating or strengthening an existing machinery for coordinating all aspects of the building materials industry, assisting in the preparation of a building materials development plan and monitoring its implementation;

(c) Ensuring a balanced development of building materials industries in all parts of the country usnng a mix of large-, medium-, and small-scale production units employing technologies that are appropriate to local economic, social and technical conditions;

(d) Encouraging the establishment of small-scale building materials industries and setting up suitable institutions to promote their growth in both urban and rural areas;

(e) Creating or strengthening local institutions and facilities for designing and fabricating machines, equipment and spare parts required for locally developed technologies and also to maintain the operatoon of plants based on imported technologies;

(f) Promoting research and development activities in the field of building materials and building techniques and ensuring the extensive adoption of research findings in practical projects;

(g) Encouraging standardization, quality control and building legislation activities that promote diversification in the range of materials available for construction. This should include formulating suitable standards for local building materials, setting up efficient testing laboratories and reformulating existing building codes and regulations to include specifications and guidelines for the use of local building materials;

(h) Giving special attention to the development of manpower of all categories, including entrepreneurs, for the building materials industry and setting up appropriate to aiming facilities and programmes;

(i) Mobilizing financial resources, both local and foreign, to support projects in the building materials industry;

(j) Encouraging the participation of the private sector in the development of the industry by providing suitable incentives including facilitation of access to credit and provision of land and infrastructure at concessionary rates;

(k) Promoting the widespread use of newly developed materials and building techniques by supporting demonstration projects and also ensuring their utilization in projects sponsored by the government in both urban and rural areas.

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INDICATORS FOR REVISED BUILDING CODES AND REGULATIONS IN AFRICA

SUMMARY

There is a growing realization among construction experts in the African region that the scope of technical considerations in building codes needs to be reviewed and expanded beyond the traditional preoccupation with structural safety.

Building codes have implications not only for the construction sector but also for national economic and social development. Particularly for the latter, building codes could contribute to import substitution, domestic production of building materials, creation of employment avenues, reductions in construction costs as well as public safety. Most of the existing codes in the African region, however, contribute little to the realization of the above.

There is therefore the need to reformulate the codes in the context of who they are meant for and what they can achieve for the community. Interest should be shifted to the interface between the building and its users, the structure and its environment, the edifice and the land on which it stands. Building codes in the African region, public health legislation, community planning, and national economic development should be compatible. In order to achieve the above, there is the need for a reformulation methodology which incorporates the main interacting factors in the building process - building technology, national economic resources, requirements of the user and the goals of the society.

In addition to the reformulation methodology there is the need to develop national standards as well as establish standing review committees.

The paper briefly discusses all the above subjects and goes further by indicating the roles that should be played by national governments, research institutions, consultants and the UNECA in the reformulation exercise.

I. INTRODUCTION

1. Since their incorporation into the building process in the African region, building codes have been regarded as exclusive documents of the building authorities. It is understood that building codes could constitute some significant variables in determining the appropriateness of the settled environment. It is argued that the latter could be achieved since the codes would set guidelines and controls defining the quality of structures, regulate the efficient use and occupancy of space, materials utilization, building services, construction safety, and public health.

2. In practice, however, the existing codes had contributed little in achieving most of the above. Emphasis within the codes have been restricted to the safety and rigidity of structures while the suitability or acceptability of building materials and components have been tagged to foreign standards and specifications to the neglect of local building materials, traditional building technology and skill.

3. In effect, most of the provisions of the existing codes have become obstructive instruments to the rapid development of buildings while in other cases they contribute little to national development. There is therefore the need for the reformulation of the existing codes.

4. Several attempts have been made at the individual country level - as well as at the UNECA, to reformulate the existing codes for the region. Most of these attempts have achieved little success mainly because they have failed to analyse the causes of the current ineffectiveness of the codes. In addition, the earlier attempts to reformulate the codes failed to develop any consistent methodology which would facilitate discussion at the local level regarding the suitability of the reformulated codes. Above all, there has been a general failure to develop a framework which would incorporate the main inter-acting factors in the construction process to ensure that codes provisions could effectively resolve the existing constraints.

5. The above problems have seen briefly examined in the paper. It may be mentioned that the objective is not to provide an outright solution to the problems posed by the existing codes; rather the attempt is to develop a consistent methodology which would enable each country to undertake its own reformulation exercise.

II. IMPLICATIONS FOR NATIONAL DEVELOPMENT

6. The primary objective of building codes in the African region has been to set guidelines and controls that would define the quality of structures. To the latter extent, the subject has been inordinately controlled by engineering requirements to ensure the rigidity and safety of buildings. The implementation of the codes has however indicated that the latter has far reaching results for national economic development. Some areas of relevance to national development are briefly discussed as follows.

7. Import substitution: Quite often, building codes specify the types of building materials that are acceptable for construction. The explaination is that in order to ensure structural safety, the quality and durability of materials should have proven records. Accordingly, such materials as cement, iron/steel, glass and treated timber are universally utilized throughout the African region.

8. The above requirement of building codes has led to increased importation of building materials into the region. For example, the region imported about US$1,031 thousands worth of iron/steel products in 1973; while about US$274,703 thousands was spent on importing sawn timber alone.

9. The argument is that the existing codes have contributed to the creation of export markets for the developed countries thus constituting a major drain on the scanty foreign exchange reserves of the African region. A change in the existing codes towards the increased substitution of imported building materials could contribute substantial foreign exchange savings to the region.

10. Domestic production: Closely related to the subject of import substitution is the effect of building codes on domestic production. Several research institutions in the African region have developed suitable local building materials particularly for house construction. These materials range from clay products, through secondry timber species, natural and artificial pozzolana to agricultural waste products such as groundnut husks.

11. However, since the existing codes still depend upon foreign standards and specifications, the said products are not extensively utilized. Building codes could encourage domestic production of several materials once they are covered by the provisions.

12. Creation of employment avenues: Another major area where building codes could be relevant to national development would be to contribute towards resolving the regions' unemployment problems.

13. It is noted, for example, that in 1982, the construction sector employed 5.8, 9.5, and 4.9 per cent of the total labour force (in paid employment) in Kenya, Swaziland and Zimbabwe respectively. The above figures are low when compared with those of the industrial countries which are at an average of 10 per cent.

14. Building codes would contribute to reduce the level of unemployment in the African region if they could incorporate the extended use of local materials, the domestic production of the latter, the utilization of increased numbers of building skills trained in the informal sector and the encouragement of appropriate construction technology, at least, for house building.

15. Construction cost reduction: Another area in which building codes could have implications for national development relates to cost reduction in public construction projects. Studies conducted in some member countries indicate that several construction projects could not be completed on schedule because specifications and standards requirements could not be readily met. Delays in project completion inevitably result into cost escalations.

16. It is estimated that in 1970, the African region spent some US$5,228 millions on construction - a reasonable percentage of which could have resulted from cost overruns. The region could achieve appreciable cost reductions in construction costs with the adoption of appropriate building codes.

17. Rural-urban migration: Building codes could have indirect effects on rural-urban migration and hence upon national development. Usually, the processing of timber, clay, lime stone, agricultural waste and similar other resources for the building sector imply the establishment of industries in the rural sectors. Most of such industries utilize sizeable numbers of unskilled and semi-skilled labour which are available in the rural areas. The incorporation of locally processed materials into codes provision could contribute indirectly to the creation of job opportunities in non-urban areas and contribute to retard the trend of rural-urban migration.

18. Public health: The objectives of building codes as related to drainage and sanitation, have [illegible] implications for public health. Among the primary objectives is the need to prevent the spread of communicable diseases.

19. It is noted for example, that in 1976 out of 10,770 deaths (in Egypt) related to infective and parasitic diseases, about 2,881 were related to diarrhoea. During the same year in Mauritius, out of 471 deaths related to infective and parasitic diseases, about 70% were diarrhoeal related. Similar figures could be available on other member countries. Much of these could however be prevented under effective drainage and sanitation provisions in building codes.

20. Safety of the user and the public: A final area where building codes would be relevant to national development relates to the safety of the people. In fact, the safety factor is related in all aspects of codes, ranging from the strength and

rigidity of structures, through the prevention of fire and lightning protection of buildings. A specific subject area of codes deals with construction practice and safety.

21. It would be argued that the ultimate goal of national development is the safety and welfare of the people. In this regard, building codes would contribute to national development by protecting the safety of the user and the public.

22. Conclusion: One would therefore conclude that in the face of the current economic and social crisis confronting the African region, the time is due to reformulate the existing building codes to contribute effectively towards national economic reconstruction efforts. No longer should building codes be viewed in the restricted scope of safety and rigidity of structures. Their roles in national development - particularly import substitution, foreign exchange savings, employment creation, local production, rural-urban migration and public safety-should be equally valued. The obvious question to ask then is whether the administration of building codes has contributed to achieve any such national development objectives in the African region.

III. CONSTRAINTS POSED BY EXISTING CODES

23. It is unfortunate to indicate that the existing building codes have not contributed significantly to the development of the African region as would be expected from all the objectives noted earlier. While all the codes have been copies from similar ones administered in the countries which have colonized the individual African countries with little or no modification, the codes have not undergone any significant revisions as have been the practice in the developed countries. The result is that the administration of the codes have posed several constraints to both the construction sector and national development. Some of these constraints are the following.

24. Cumbersome procedures: The prescribed procedures for obtaining building permits are very cumbersome, ranging from the submission of applications, through recording, inspection, modification to rejection or approval. Further each application is accompanied by, at least, six different plans (submitted in triplicate) each requiring detailed technical information.

25. The constraint is that the applications require unnecessarily long periods for processing. In certain events, the application forms are lost in the process. Thus while the housing deficit of the region is on the increase, the efforts of prospective builders are frustrated by cumbersome administrative procedures.

26. Lack of clarity: Most often, the provisions of the codes lack clarity or else they utilize such technical terminologies that cannot be readily understood by the ordinary builder. Complex codes provisions could always be given different interpretations when issues of responsibility result. Above all, they could render legal enforcement rather difficult.

27. Unified codes for diversified areas: With vast geographical expanse, transcending different climatic and earthnic groups, varied traditional building technologies and local building materials, most parts of the African region adhere to unified codes. The imposition of such unified codes prohibits the full utilization of the regions'

traditional building technology, skills and materials endowments.

28. Structural design: A primary problem relating to structural design requirements contained in the codes is the inordinate engineering requirements of safety and regidity over the entire construction process. Once the design has been completed, the construction technology and building materials are dictated and construction could only proceed according to the specifications (which are foreign). Constraints often result, for example when approved materials are in short supply. The obvious results are delays in project completion and cost overruns.

29. Utilization of local building materials: A further technical constraint is that the existing codes do not encourage the utilization of local building materials. Building codes in the African region are based on foreign specifications since African countries are yet to establish their own standards and specifications. In effect, since local materials have no comparable standard and specifications, they are ignored by the designers.

30. The resulting problems are numerouse, ranging from increased imports, through drains on scarce foreign resources, increased construction costs, to frequent hold-ups in the construction process.

31. Illegal structures: Often, low-income structures which are not built to standard requirements are termed illegal structures. It would appear that with the current rate of urban growth, an approach to provide housing to the majority would be to utilize whatever resources that are available without very stringent application of foreign standards.

32. Inadequate coverage: A further constraint posed by the existing codes is that they do not adequately cover all the important areas of the construction sector. None of the existing codes provides for occupancy classification. For most countries also, the prevention of fire and lightning protection in buildings have either been omitted or inadequately covered.

33. Drainage and sanitation: Most of the approved methods specified under the codes for the disposal of garbage and human excreta pose several constraints.

34. The bucket-privy system utilized in several urban settlements of the region does not fulfil most of the basic objectives of sanitation. Where pit-latrines are used, the contents often overspill during rain storms not to mention the hazards of seepage into water tables.

35. Maintenance: Some of the codes provisions fail to appreciate maintenance difficulties that could result from the approved methods and standards. For example, open drainage channels in several settlements of the region are often chocked with solid wastes causing flood water to overflow during rain storms due to lack of maintenance. The provision of garbage collection centres in several urban areas have met with little success. Often, the garbage remains uncollected for long periods thus resulting into breeding grounds of rodents and virmine.

36. Static nature of codes: It might be observed that quality standards available in the codes are generally formulated by experts and then incorporated into the codes. In as much as these codes are not regularly reformulated with technological changes, they would tend to become static instruments and consequently, would not

respond to the needs of the majority. Unfortunately, the codes of several member countries have remained unchanged for years and thus unresponsive to changes in technology and settlement structure.

37. Affordability: Another area of concern about the existing codes is that the provisions are not often affordable by the majority of people. Building codes are meant to be implemented by individuals and the society. The basic question to ask then is whether the user can afford the costs involved. Experience from several countries indicates that the majority of the country's population cannot afford the standards set in the codes. In effect some provisions of the codes have become discriminatory instruments catering for the needs of a privileged few.

38. Acceptability: A closely related constraint is that several standards which are traditionally acceptable to the region's population have been rejected by provisions of the codes. It would be noted that much construction (particularly housing) is undertaken with traditional skill and technology. The "poto-poto" (Cameroon) and "chika" (Ethiopia) types of construction are examples. These and similar types of construction are suitable to the technology and rent capacities of the majority of the region's population. Unfortunately, they are not acceptable to the building codes in several countries. It could however be stated that the formalisation of the knowledge which the people have already acquired with particular regards to technology, skills and materials, could be great assets to the construction sector.

39. In conclusion, it would be stated that the existing building codes pose too many constraints to both the construction sector and national economy as a whole. It would therefore appear that there is a need to reformulate the existing codes.

IV. NEED FOR REFORMULATION

40. The foregoing arguements are explainatory enough and auger sufficiently for a need to reformulate the existing codes. A summary of the obvious need for reformulation are presented below.

41. Administration: The administrative aspects of the existing building codes should be reformulated in order to circumvent the cumbersome procedures and minimize delays in the processing of building permits. The codes provisions should be made clear to purpose, detail out specific objectives and identify responsibilities. Above all, the administration of building codes should emphasize assistance to the low-income builder, and participation of dwellers in the maintenance of infrastructure within the settled sectors.

42. Enforcement: Codes normally require statutory recognition and legal support for an effective enforcement. However, there is a need to re-examine the existing strict legal enforcement procedures which emphasise court action, recourse to penalties or even demolishing. There is the need to develop a gradual enforcement procedure which incorporates education, persuation and direction as against the application of statutory force which should be the last resort.

43. Structural design requirements: The structural requirements contained in the existing codes may also have to be revised. Perhaps a distinction may have to be made between high income multi-storey structures on the one hand and low-income simple

buildings on the other. For the former, a strict adherence to engineering standards and specifications would be inevitable; for the latter however, the existing requirements regarding design standards, and specifications for materials may have to be fairly relaxed. To the latter end, the extended use of traditional building skills, technology and local materials may have to be incorporated in order to reflect the user's affordability and living habits.

44. Economic considerations: The need to reformulate existing codes to reflect national economic goals cannot be neglected. The existing building codes should be reformulated to reduce imports of materials, equipments and skills, to promote the local production of materials, to encourage the extended use of local materials, to generate employment as well as contribute to retard the growing trend of rural-urban migration.

45. Public safety: Finally, there is the need to reflect more public safety measures in the codes provisions. The codes should be reformulated to include suitable drainage and garbage disposal systems, adequate means of fire protection and prevention of lightning in buildings.

46. It is only when the above changes are reflected in the reformulated codes that the latter would be contributing positively to the development of both the construction sector and the national economic development.

V. FRAMEWORK FOR REFORMULATION

47. Previous approaches: An examination of the existing reformulated building codes for some African countries indicates that several partial solutions have been proposed in order to improve upon the housing situation in the region. Four of such partial solutions common with the reformulated codes in the region include:

- setting of minimum standards for low income housing commensurate with the user's rent capacity.
- the establishment of maximum standards for housing as a means of curtailing luxury and for a more equitable distribution of average housing among the majority of the people.
- the use of local building materials as cheap substitutes for expensive imported items with the objective to promote local industry.
- the development of testing facilities as a basis for control and promotion of local standards.

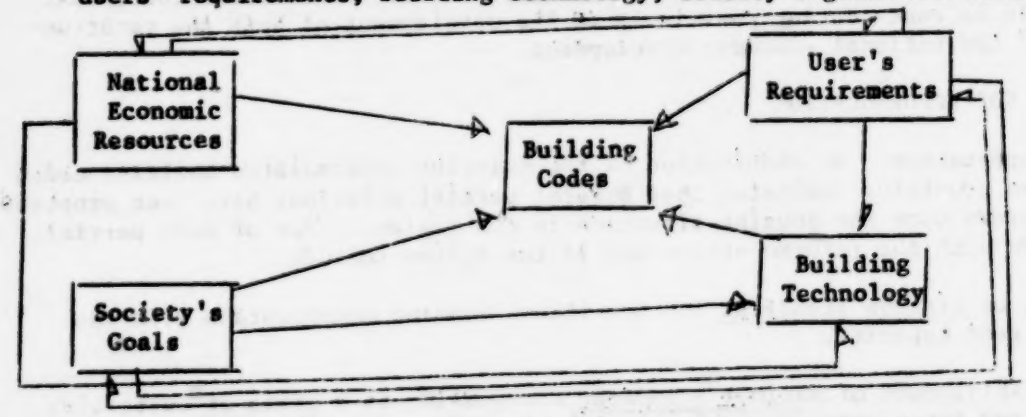
48. There is no doubt that the above solutions could be vital to the housing industry of the African region. However, while the proposals may immediately appear attractive, the objective of reformulation should not be to come up with a complete set of building codes, whether these are adapted or designed for specific countries, or whether they are based upon any of the above partial solutions. The basic question is whether the outright proposition of such solutions could facilitate any constructive discussion at the national or local levels regarding their suitability and appropriateness. Further more, such solutions may not facilitate periodic reviews, particularly by the nationals, when changes occur in the structure of the construction sector.

49. In view of the foregoing problems, it could be argued that the reformulation of building codes in the African region should aim at developing a continuing process which combines an analysis of which codes could be enforced, with a gradual development of an enforcement procedure and administration. In addition, in order to ensure that the codes are suitable to all factors, a methodology which incorporates successive stages in the development process would be very useful since it would facilitate an assessment at each stage through the comparison of relative advantages.

50. Factors for consideration: What should be noticed is that the smooth functioning of the building process involves the interacting of four main factors - building technology, national economic resources, requirements of the user and the goals of the society. Thus unless building codes are reformulated to take due account of all the above interacting factors, constraints could result, rendering the codes unsuitable.

Fig. I

Schematic programme showing the relationship among national economic resources, users' requirements, building technology, society's goals and building codes



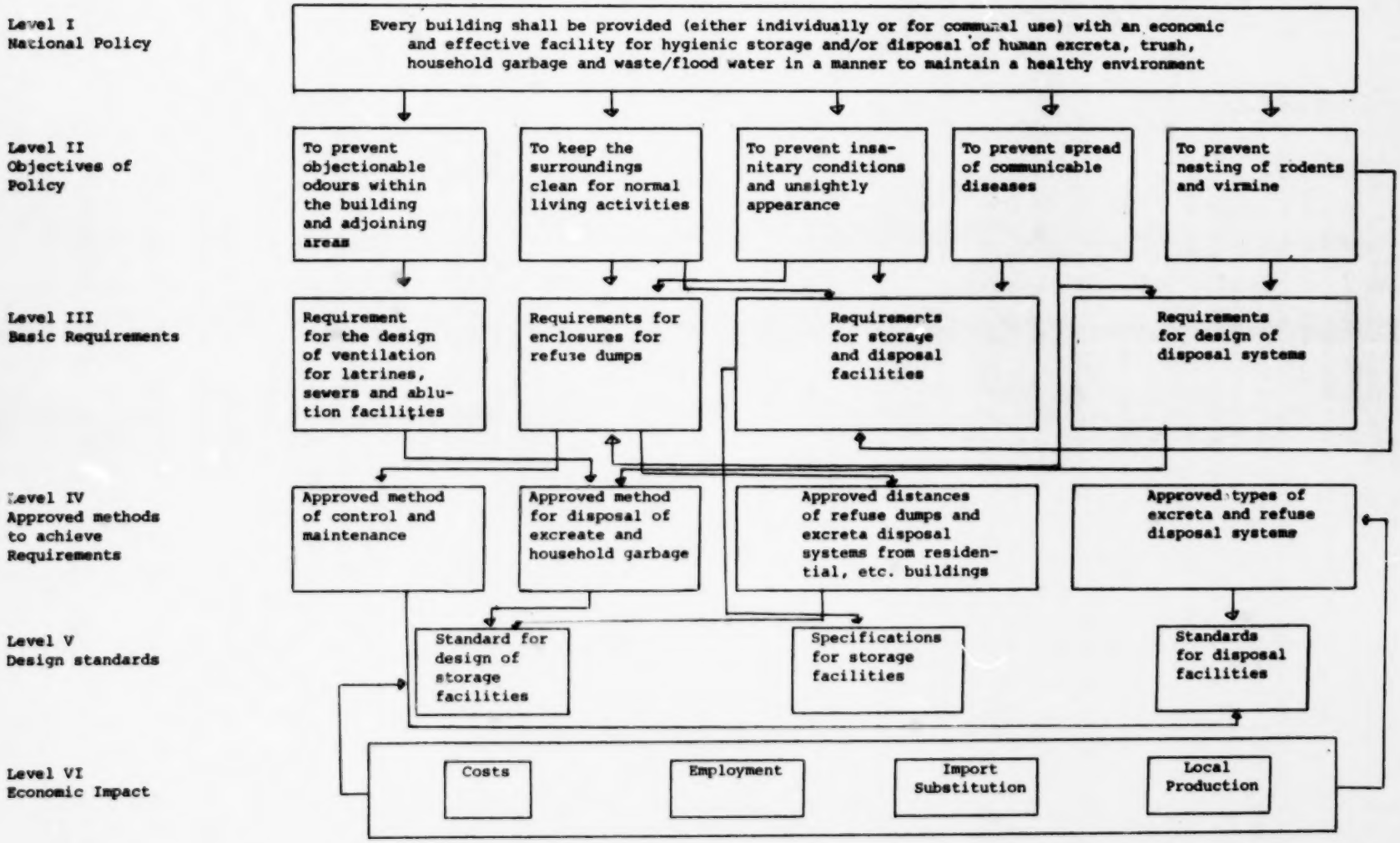
51. An examination of the existing codes in the African region would however indicate that considerations of building technology have played the dominant role in determining the nature of codes and regulations. The failure to effectively relate codes provisions to the other three factors explains the unsuitability in several respects. Once all the four factors are correlated, the existing constraints would be minimized.

52. In addition to the above, it would be necessary to decentralize the codes in order to reflect differences in settlements structure and climate, variations in earthnic, cultural, technological and materials endowments which characterize the regions indegenous building industry.

53. Finally, it would be necessary to establish a mechanism for gradually incorporating changes in building technology into the established codes provisions as well as a system for periodically reviewing the administrative and legal systems for codes enforcement.

FIGURE I

EXAMPLE: Sanitation


Level I
National Policy
Every building shall be provided (either individually or for communal use) with an economic and effective facility for hygienic storage and/or disposal of human excreta, trush, household garbage and waste/flood water in a manner to maintain a healthy environment
Level II
Objectives of Policy
To prevent objectionable odours within the building and adjoining areas
To keep the surroundings clean for normal living activities
To prevent insanitary conditions and unsightly appearance
To prevent spread of communicable diseases
To prevent nesting of rodents and virmine
Level III
Basic Requirements
Requirement for the design of ventilation for latrines, sewers and ablution facilities
Requirements for enclosures for refuse dumps
Requirements for storage and disposal facilities
Requirements for design of disposal systems
Level IV
Approved methods to achieve Requirements
Approved method of control and maintenance
Approved method for disposal of excreate and household garbage
Approved distances of refuse dumps and excreta disposal systems from residential, etc. buildings
Approved types of excreta and refuse disposal systems
Level V
Design standards
Standard for design of storage facilities
Specifications for storage facilities
Standards for disposal facilities
Level VI
Economic Impact
Costs
Employment
Import Substitution
Local Production

VI. METHODOLOGY FOR REFORMULATION

54. Based upon the foregoing discussions, it is necessary to develop a reformulation methodology for codes in the African region. The proposed methodology - evaluation method - follows four identifiable stages as indicated below.

- decentralize the country
- provide a framework
- evaluate proposed methods and standards
- evolve a gradual administrative and legal system
-

The stages are briefly discussed as follows:

55. Decentralize the country to reflect particularly climatic, and (traditional) building technological differences as well as local building material endowments. Decentralization may also be required to reflect differences in settlement structures particularly urban, pre-urban and rural settlement structures. In reformulating the existing codes, it may be necessary to prepare separate codes provisions to cover the above, whenever major differences occur. For example, where there exists the traditional technology for the use of dimensional stone and timber in different regions of one country, separate codes provisions should be made for the formal acceptance of both technologies in the codes. Different codes provisions may similarly be needed for simple rural/pre-urban buildings as against multi-storey structures found in urban settlements.

56. Provide a framework to cover the main interacting factors, namely building technology, national economic resources, requirements of the user and the goals of the society. This is needed to shift emphasis from the existing overriding requirements of structural safety and rigidity to the equally important factors mentioned above.

57. Evaluate proposed standards to ensure that they are suitable to the four interacting factors and also to indicate the successive stages of thought through which the codes would be reformulated. The latter requirement is needed to facilitate discussion by both professionals and non-professionals at the local level. The proposee evaluation procedure follows six stages of systematic development as indicated below:

Stage I — State the overall national policy regarding the subject for which the codes are being reformulated

Stage II — Identify the specific objectives of the policy

Stage III — Provide details of the basic requirements needed to achieve the objectives

Stage IV — Indicate the approved methods (or facilities) that could be used to achieve the requirements

Stage V — Specify the design standards required to implement the proposed methods

Stage VI — Analyse the impact of the approved method and design standards upon the four interacting factors

58. The process has been illustrated in Figure 2. It would be noted in the said figure that each stage serves a specific purpose, taking note of the fact that as statutory tools, building codes should originate from broad national policies aimed at achieving specific objectives. The role of the technologist is to propose appropriat alternative technical solutions that could effectively meet the objectives. However, these alternative technical solutions should only be acceptable as codes after they have been designed, based upon acceptable standards and the impact of the design is deemed to satisfy the requirements of the four interacting factors. A simplified impact analysis is presented on the four interacting factors in table I. Although the example provided in table I is rather simple, it could help in clarifying several issues. In particular, it could facilitate discussion by both professionals and non-professionals regarding the suitability of a proposed facility in a code.

Table I. Simplified Impact Analysis - Excreta Disposal

Factor/approved method		Wate Closet	Pit Privy	VIP
National Economic Resources	Costs	High	Low	Moderate
	Materials	Imported	Local	Local
	Labour	Partly foreign	Local	Local
	Production possibility	Foreign	Local	Local
	Employment opportunity	Low	Low	Moderate
Technology		Advanced	Low-cost	Intermediate
Users requirements		Very satis-factory	Not very satisfacto-ry	Satisfactory
Society's goals		Very satis-factory	Not very satisfacto-ry	Satisfactory
Opportunity cost		High	Low	Low
Sectoral application		Urban (with running water)	Rural	Urban and Rural
Recommendation (Decentralization)		For urban (with running water)	Rural	Urban and Rural

59. Evolve a gradual administrative and legal system for enforcement, which incorporates persuation, government assistance and local participation as against the use of statutory force which should be the last resort.

60. In addition to the proposed methodology, two other areas require attention, namely:

- the development of local/national standards
- the establishment of a review committee

61. A standing committee for the periodic review of the codes would be essential to keep the latter in line with changes in building technology as well as for the incorporation of newly developed building materials. On the other hand, the continued utilization of foreign standards and specifications would imply the continued importation of building materials and the neglect of available local building materials. Under such conditions, the reformulated codes could degenerate into further obstructive instruments. The development of national standards would therefore be an eventual complement to any reformulation methodology.

VII COLLABORATIVE FUNCTIONS

62. The effective reformulation of existing building codes of the region would require the co-operation of all institutions involved in the building process. Some of these institutions and their roles are discussed as follows:

63. National governments: African governments have the key role to play in the reformulation of existing building codes for their respective countries. Among others, the governments should provide the needed financial support for reformulation and periodic review of codes. In line with the latter, governments should establish standing committees which should assume the responsibility of reviewing the codes from time to time according to structural changes in settlements, and innovations in building technology. A final responsibility of the government would be to provide the necessary statutory legislation or legal backing for the effective administration of the codes.

64. Research institutions: These could contribute towards the reformulation of building codes in three main areas, namely:

- provision of data
- development of national standards and specifications for materials and components
- development of a data bank

65. Research institutions have the main function of providing data on new building materials and appropriate building technology for incorporation into the revised codes. Particularly for the African region, several local building materials have been developed through research, although their utilization has been hampered by restrictions imposed by the provisions of the codes. Data on such developments could be incorporated into the revised codes.

66. Another area where research institutions could be effective is the development of national standards and specifications for materials and components. As noted earlier

the African region still depends upon foreign standards and specifications. Even with regards to some locally developed building materials, no comparable standards have been provided. The result is that designers have difficulty in incorporating most of such local materials into their works. Research institutions would be useful in developing such standards and specifications on national or even sub-regional levels.

67. A final role of the research institutions would be to develop data banks on the entire construction sector. This would facilitate the reformulation exercise since relevant data could always be available at the data banks. Research institutions could also constitute the nucleus of the review committees.

68. Consultants and contractors: with their practical experiences in the design and construction of buildings and related infrastructure, consultants and contractors could provide data on local soil and climatic conditions for incorporation into the data banks. Consultants could also participate directly in the reformulation exercise.

69. UNECA: The UNECA by virtue of its wide experiences in building conditions throughout the African region as well as close relations with other regions of the world would be effective in providing necessary data to individual countries to assist in reformulating the codes. Similarly the ECA could be effective in establishing data banks and the interchange of information among member countries. Finally, where resources are available, the ECA could directly assist member countries or groups of countries in reformulating their existing codes.

VIII CONCLUSION

70. The basic causes of the unsuitability of existing codes in the African region stem among others from four basic causes:

- The inordinate emphasis on structural safety without due attention to other equally important factors.
- Failure to revise the codes periodically in the presence of technological changes.
- The absence of national or local standards and specifications which tends to mitigate against the use of local building materials and technology.
- The adoption of unified codes which disregard geographical diversity, traditional building skills/art and local building materials endowments.

71. An acceptable reformulated building code should provide effective solutions to all the above. To that latter end, there is the need to develop a consistent methodology for reformulation which would enable both professional and non-professionals to evaluate the relative advantages and disadvantages of proposed standards and methods. In addition, there is the need for member countries to develop their national standards and also to review the codes periodically.